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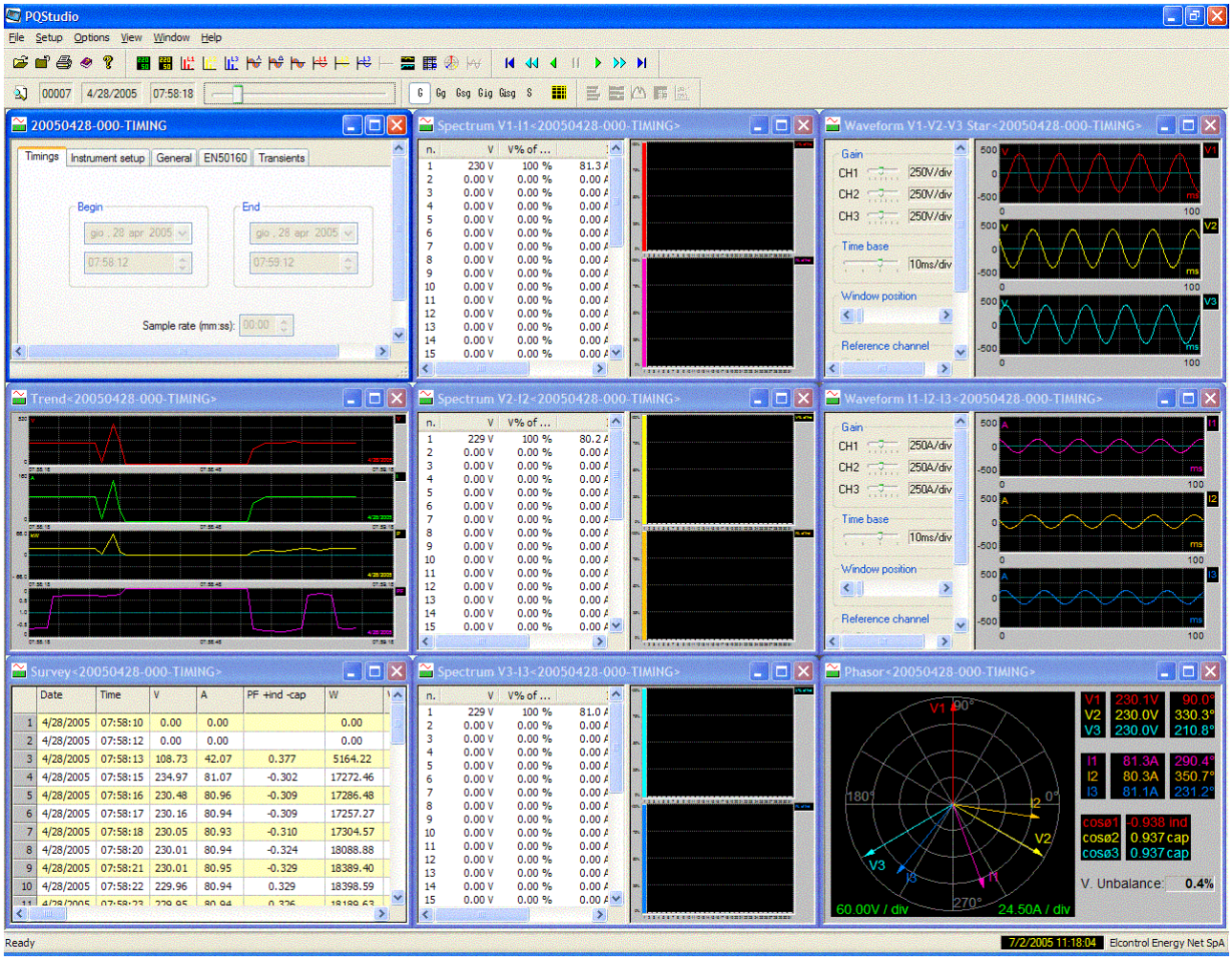
PQ Studio

User's Manual – Rel. PQS-0.2

**Power Quality analysis software in Windows environment
for the JUPITER professional analyser**



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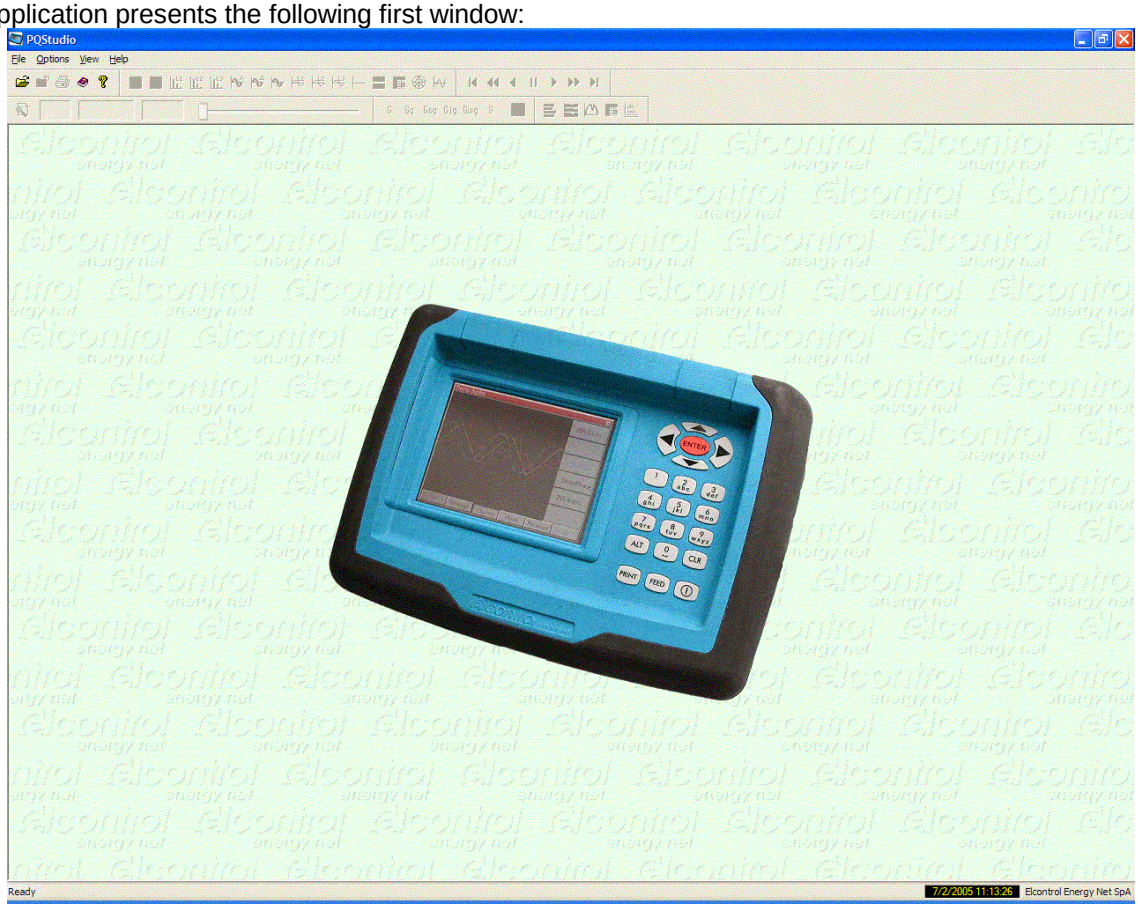
1 General description

PQ Studio is a software application in Windows environment that lets you process the data recorded by the JUPITER professional analyser of electrical energy quality. PQ Studio is able to repeat all analyses performed by JUPITER on the system. It therefore lets you reconstruct waveforms, energy data and the events that occurred during the measuring campaign.
JUPITER saves the measuring campaigns on a Compact Flash (CF) type of memory. The data stored in it can later be transferred onto the PC for analysis, creating and printing reports, filing and other important functions.
The program envisages only the *OFF-Line* operating mode, i.e. it does not interact by communicating with the instrument. In order to transfer the measuring campaigns, you have to first remove the memory from JUPITER (*always remembering to turn off the instrument beforehand*). By using a proper external CF memory reader or a PCMCIA adaptor, data can be copied onto the hard disk using the *Copy – Paste* function of Windows Explorer. It is also feasible to open the files directly from the CF. The organisation and types of measuring campaigns will be looked at in detail farther on.
It is possible to analyse two or more campaigns at the same time. The only limitation is the PC's computing power, available memory and disk space.
The default language can be selected in real time by changing the international settings for the numbers, currency, date and time, etc. The program configures itself with the local international settings with the first execution.

1.1 The main window

The application presents the following first window:



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It is made up of a title, main menu, and toolbars (for quickly accessing the application's most important functions). There is also a work area where the different windows with the instrument's measurements, graphs, etc. are displayed, etc., and a status bar with the system clock.

1.2 The main menu

- **File**: operations associated with the opening, printing and print preview of a measuring campaign file.
- **Options**: setting the default language.
- **View**: display selection of the different tool bars and status bar.
- **?**: display of the window with the program information and online help.

A series of icons depicting the tool bars are underneath the main menu. They are divided into five types: *main, view control, measurement trend control (recorder function), record position, harmonic spectrum mode and EN50160*. The user can freely enable/disable their display using the **View** command of the main menu. It is also possible to customise the position of each bar by proceeding as follows: with the mouse, point in the area adjacent to a toolbar's buttons and move the cursor with the left mouse button pressed. The selected toolbar disengages from its original position and is dragged along with the cursor's movements; the toolbar is drawn in the new position when the left mouse button is released. The toolbar can be left fluctuating in a given point of the screen, or can be once again hooked on to any one of the four borders of the main window.

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2 The measuring campaigns

2.1 Preliminary notes

As previously mentioned, JUPITER allows various pieces of information that characterise the electrical phenomena to be stored in the measuring campaigns.

The measuring campaigns can be carried out in two different modes:

- **Manual**: the user manually decides when to start and stop data acquisition;
- **Automatic**: the user configures one or more campaigns in a list of campaigns. The *automatic campaign manager* continuously controls the status of the above-mentioned list, automatically executing the campaigns it contains;

In turn, there are three very distinct types of campaigns:

- **Timed**: the records with the information about the samples of the voltage and current input signals are saved in regular time intervals, from a minimum of 0 (continuous flow of data) to a maximum of 1 hour (3600 seconds)
- **Transient**: the transient type of overvoltage and overcurrent phenomena are captured in the single or repetitive event mode
- **EN50160**: the records contain the results of the electrical energy quality analyses established by the EN50160 regulations: frequency, change in voltage, losses of voltage, overvoltage between phase-to-phase, short and long interruptions, power supply voltage unbalance.

2.2 Organisation of the measuring campaigns on the CF

Every measuring campaign is stored according to a common procedure: there is a directory in the CF root directory that acts as a container of all the campaigns, and is called **Survey**. At this level – and for every new measuring campaign – a directory is created; its name will have this type of form:

YYYYMMDD-NNN-AAAA…A

where

- **YYYY** = year
- **MM** = month
- **DD** = day
- **NNN** = progressive campaign number from 000 to 999, it serves to identify the same type of campaigns over the same day
- **AAAA…A** = user-defined descriptive label

A campaign is made up of:

An **.srv** file, which is the actual campaign file where the parameters characterising it are saved. This is the document file for the program. It is a very small file, and its file name is the same as the directory containing it.

One or more **.XXXX** files (where XXXX is a number from 0000 to 9999), where the records with the measurements or samples of the waveforms are saved. Depending on the set acquisition frequency, these files may reach dimensions of about one megabyte.

There may be a file with **.srx** extension where some additional support data are saved.

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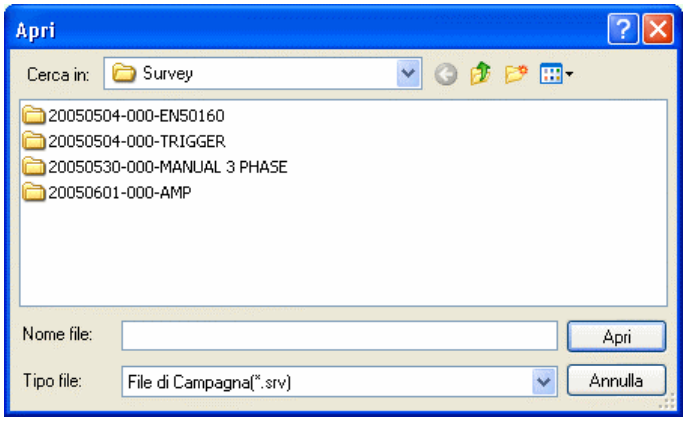
For example, let us suppose that the CF memory has been recognised by the operating system as a new unit with the letter F, then the structure of the files will be as follows:

```
F:
|
 --Survey
   |
   +--20050406-000-Manual Campaign
   |  |
   |  |--20050406-000-Manual Campaign.srv
   |  |--20050406-000-Manual Campaign.0000
   |  |--20050407-000-Manual Campaign.0001
   |   --20050408-000-Manual Campaign.0002
   |
   +--20050409-000-Manual Campaign
   |  |
   |  |--20050409-000-Manual Campaign.srv
   |  |--20050409-000-Manual Campaign.0000
   |   --20050410-000-Manual Campaign.0001
   |
   +--20050110-000-Automatic Campaign
   |  |
   |  |--20050110-000-Automatic Campaign.srv
   |  |--20050110-000-Automatic Campaign.0000
   |  |--20050111-000-Automatic Campaign.0001
   |  |--20050112-000-Automatic Campaign.0002
   |   --20050113-000-Automatic Campaign.0003
   |
   .
   .
   .
```

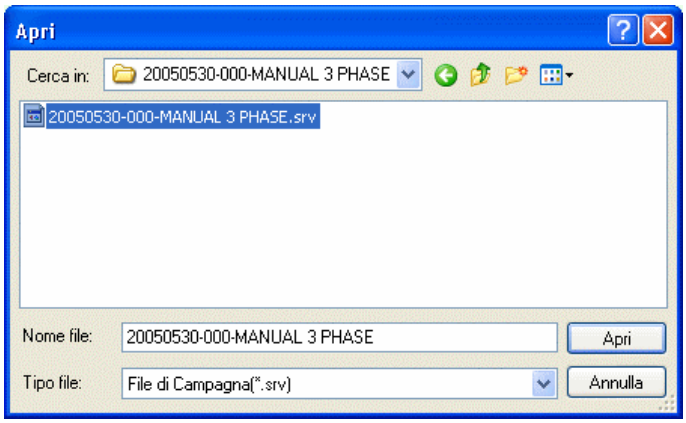
At this point a small clarification becomes necessary. Up until now it has been said – in an entirely general way – that a measuring campaign is a set of binary data organised in records. As is easy to imagine, what is contained will depend on the nature of the campaign. A record is made up of the samples for each input signal (3 under voltage and 4 under current) for a total of 60 signal periods, which at the frequency of 50 Hz are equivalent to 1.2 seconds of recording, or 1 second at 60 Hz.
It is now important to establish that the entire PQ Studio application is broken down into measurement records. The movements within the recording, the graphs, calculations and everything else are based on these packets of information.

3 Display and processing of a measuring campaign

To open and view a measuring campaign file, select the **File – Open** menu item. A first window that lets you select the desired measuring campaign directory is shown:



Double-click on the desired campaign. A second window is shown; select the campaign file and press **Open**:

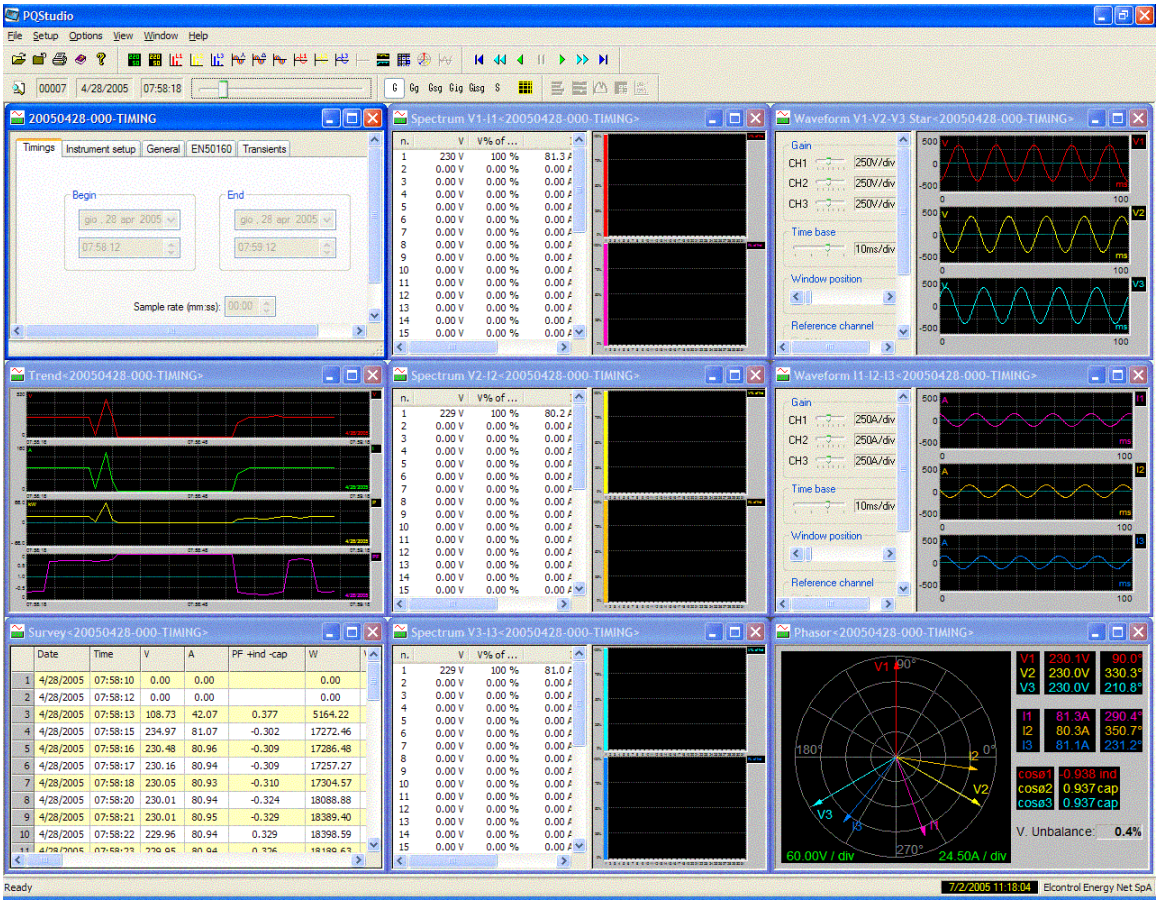


When opening, the program automatically recognises the type of measuring campaign selected (*Timed, Transient or EN50160*) and opportunely displays several windows with the views of the measurements and graphs.

3.1 Timed Campaign

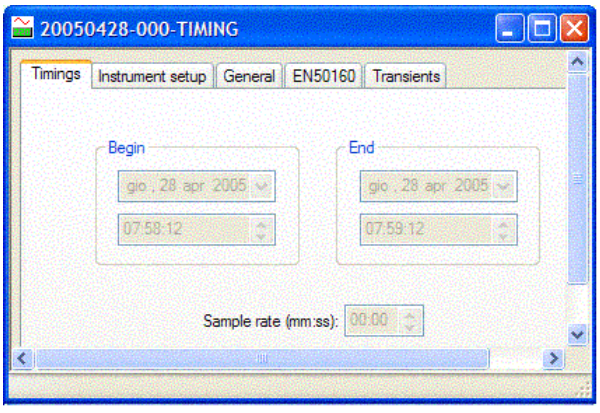
As you can see, the *Main menu* changes and takes on the structure described below (also the appropriate icons in the toolbars are enabled):

- **File**: operations associated with the opening, closing, printing and print preview of a measuring campaign file.
- **Configuration**: command for configuring the trend of the rms measurements in real time (measurements trend).
- **Options**: setting of colours for the different graphs (waveform, harmonic spectrum, trend, etc.).
- **View**: display selection of the numeric measurements and graphs, different tool bars and the status bar.
- **Window**: set-up of the arrangement of windows or to call up a certain window in the foreground.
- **?**: display of the window with the program information and online help.



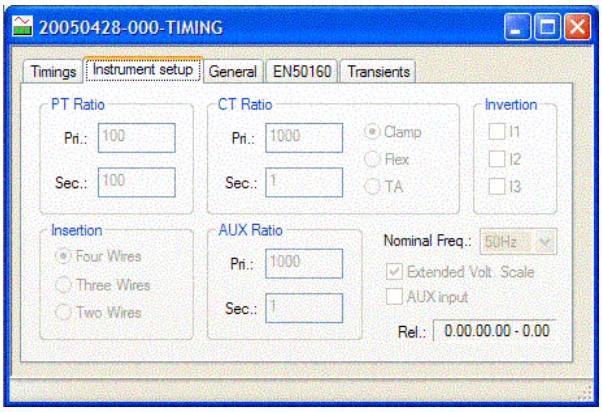
Display of the measurements and graphs is broken down as follows. There is a main window organised in cards, with the instrument's configuration parameters and the settings of the measuring campaign.

The first card, called *Timelines*, displays the recording start and end date and time together with the relevant data acquisition time (frequency time). This time may take on values from a minimum of 0 to a maximum of 60 minutes (3600 seconds).
A campaign with a frequency time of 0 is characterised by a continuous succession of data structured in records, each of which includes 60 periods of the measured signals. In the case of a campaign having a frequency higher than 0, the single records – again including 60 periods – are saved with the set frequency.
Note: as every record includes 60 periods, irrespective of the basic frequency; it results that if the frequency time is equal to 1 sec, it as well corresponds to continuous acquisition.

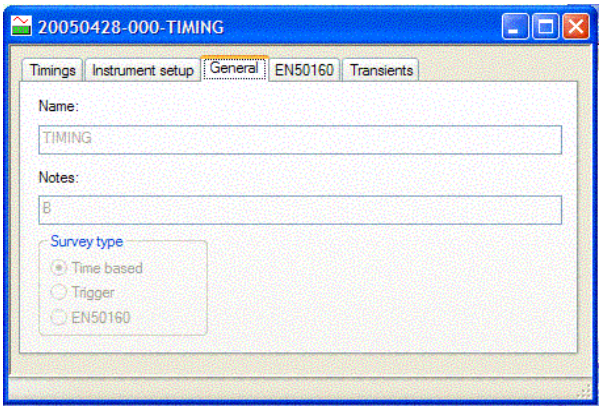


In returning to the description of our cards, we find a first part regarding configuration of the JUPITER analyser in the second card, called *Instrument Configuration*. In particular, the transformation ratios of the voltage, current and auxiliary channel inputs, the type of current sensor (Clamp-on, Flexible or TA), any

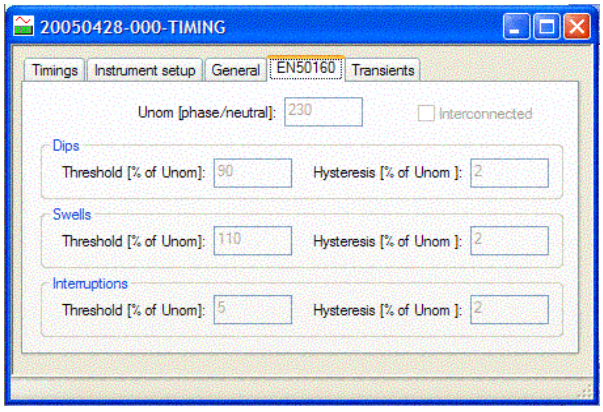
reversal of the current sensors, the type of connection (with two, three or four wires), the nominal frequency for the harmonic analysis, and the enabling of the auxiliary input and scale extended for the voltage inputs are given. Also the version of the JUPITER firmware is indicated. All of this information illustrates the conditions in which the measuring campaign was performed.

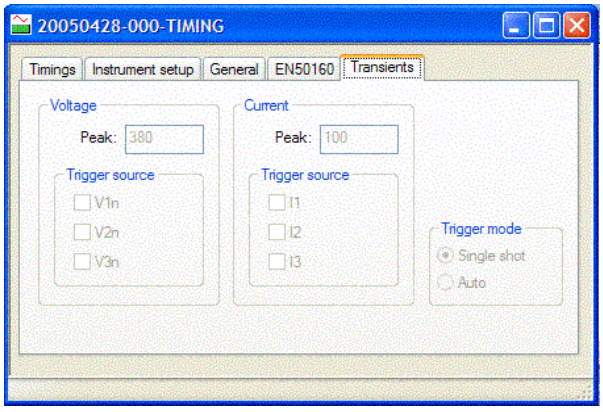


The *Main* card offers other information regarding the name of the campaign, user notes (if any) and the type of recording: Timed, Transient or EN50160.



The last two cards complete the instrument configuration overview with the parameters regarding the settings for EN50160 analysis and the threshold settings for detecting electrical overvoltage and overcurrent phenomena. These cards do not affect a Timed type of campaign, and shall be explained further on.





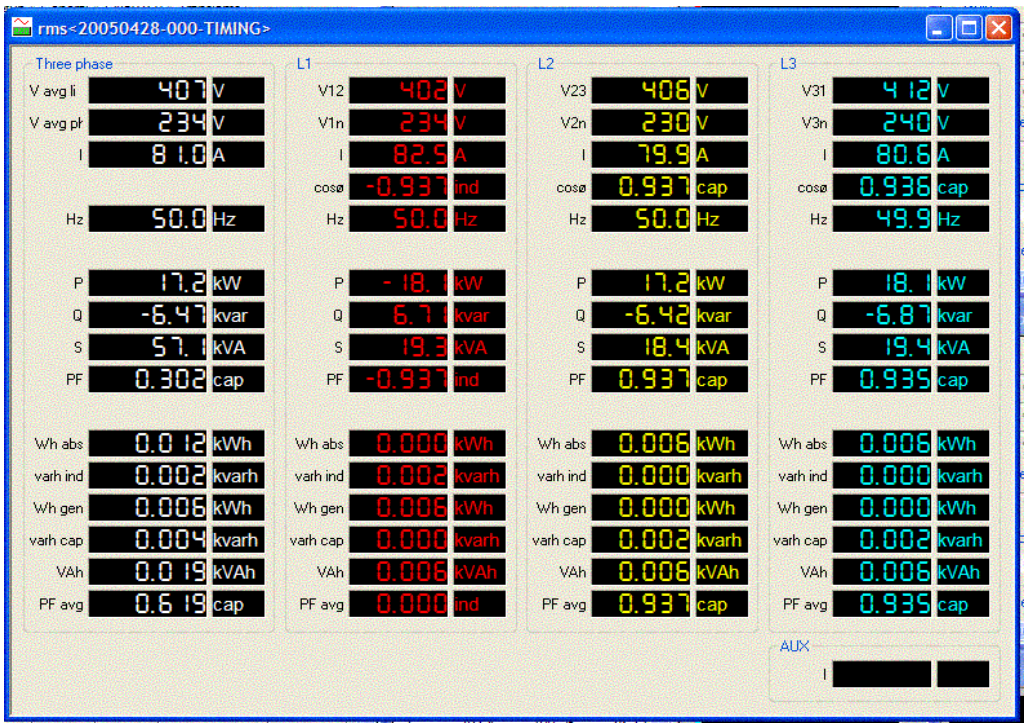
In addition to the main window, secondary windows with the numeric and graphic measurements can be viewed when the user selects them. The following views are automatically shown by default when this type of campaign is opened: Harmonic Spectrum V1-I1, Harmonic Spectrum V2-I2, Harmonic Spectrum V2-I2, Voltage Waveforms V1-V2-V3 referring to neutral (Star), Current Waveforms I1-I2-I3, Vector Meter, Trend of the rms measurements and an Excel style grid (whose lines represent the measurements for each record).

All views useful for analysing the campaign are accessible from the **View** menu, or even more directly by using the toolbar

Note that a label with short description of the button pointed at appears when moving over the bar with the mouse.

3.1.1 The rms measurements

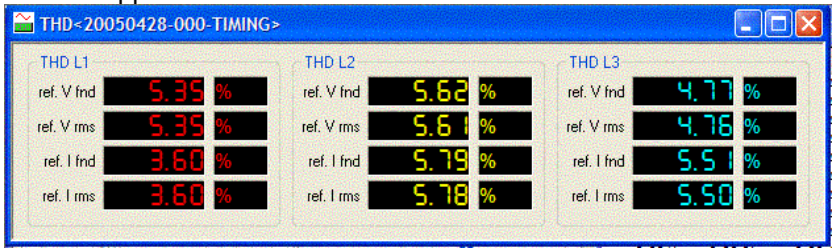
This window displays the main rms measurements, both three-phase and of the single phase, such as: voltage (V), current (I), cosø, frequency (f), active power (P), reactive power (Q), apparent power (S), power factor (PF), the four counters of active and reactive, absorbed/generated and inductive/capacitive power (Wh_{abs}, Wh_{gen}, $varh_{ind}$ e $varh_{cap}$), the apparent power counter (Vah), and the average power factor (PF avrg). Also the current of the auxiliary channel is displayed in the lower right-hand corner.



3.1.2 The THD measurements

We can identify three boxes, one for each phase, giving the total harmonic distortion factor (Total Harmonic Distortion Factor THD) of the voltage signals (THDV) and of the current signals (THDI) compared to the fundamental and to the total rms value.

Consult the user's manual supplied with the instrument for more details.



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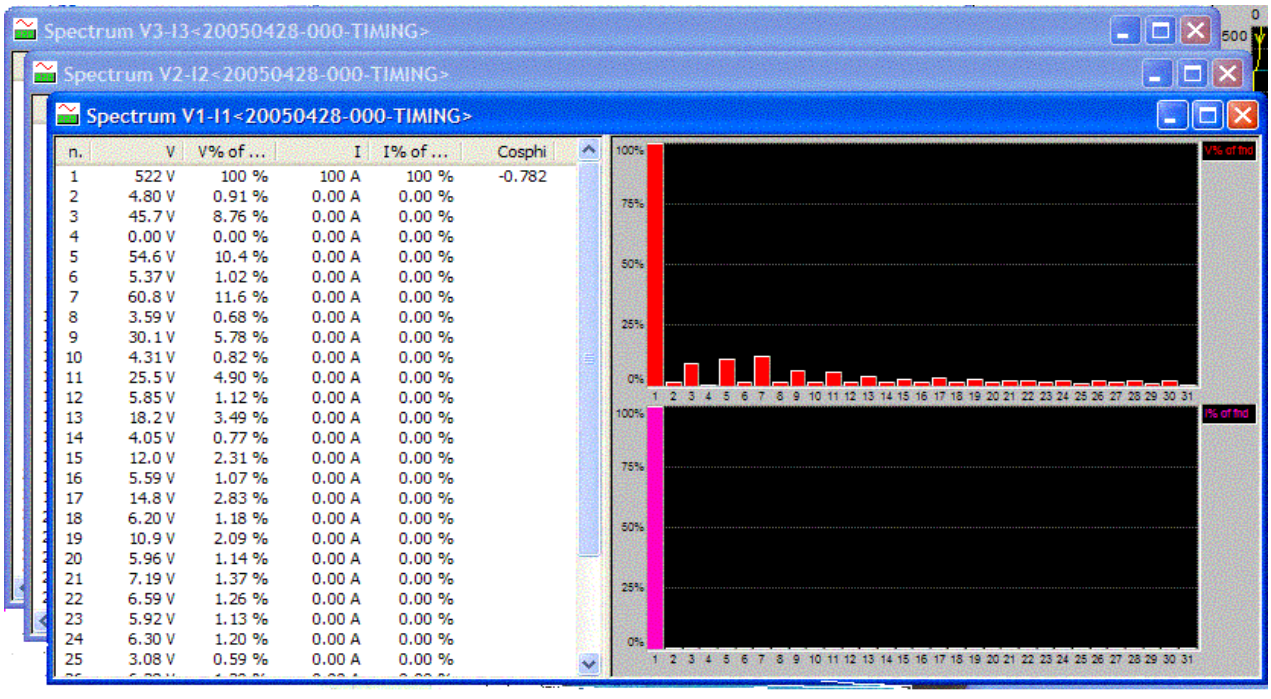
3.1.3 The harmonic and interharmonic spectrums

These windows – one for each phase – are made up of two sections placed side by side horizontally:

- One section with the numeric display of the V and I measurements and of the Cosphi value from the 1st to 31st harmonic in absolute and percentage value compared to the fundamental (display of the percentage values and Cosphi are valid only for the classic harmonic spectrum, in the other cases only the V and I values in absolute value will be listed);
- One section with the graphic display of the V and I harmonic spectrum in percentage value compared to the fundamental.

You can alter the size of the above-mentioned areas by dragging the vertical separation bar between the two sections with the mouse.
You can sort the measurements by value (from lesser to greater) by pressing on the buttons of the title of a given column in the left section. By default they are sorted by number of harmonic order (first column on the left).

When positioning the cursor on the graphs, the *Point and Measure* function is enabled: if the cursor is left for more than 2 seconds on a certain point of the graphs, a small indicator with the measurement expressed in the units of measure indicated on the vertical and horizontal axes of the system of reference in that point is automatically displayed. In our case it will be the percentage value of the harmonic component and the number of harmonic order with the relevant equivalent frequency.



It is possible to change the display mode of the spectrum and of the relevant measurements using the toolbar

- you choose between harmonic and interharmonic spectrum with the first 6 buttons, whereas you change between linear scale or logarithmic scale (only for the axis of the ordinates) with the last button on the right (shown with a yellow grid). Some examples:

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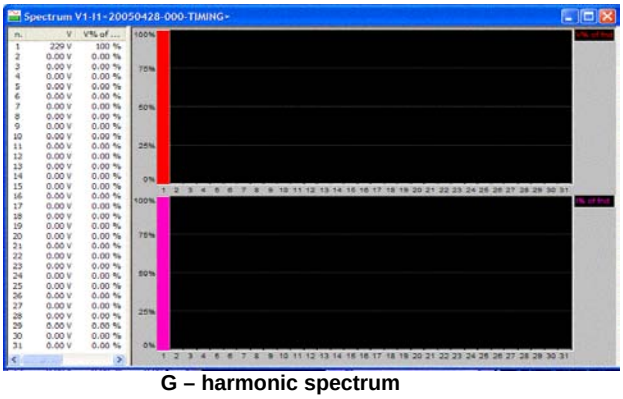
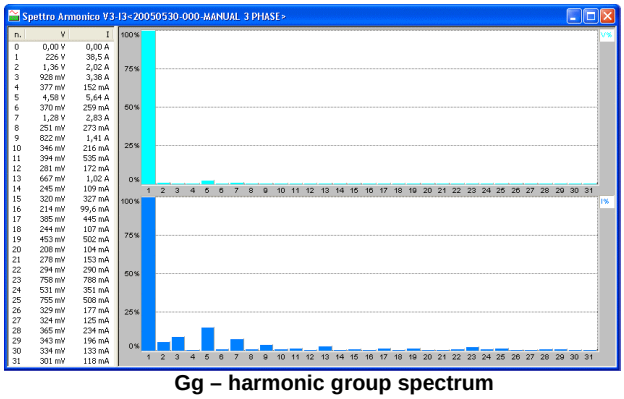
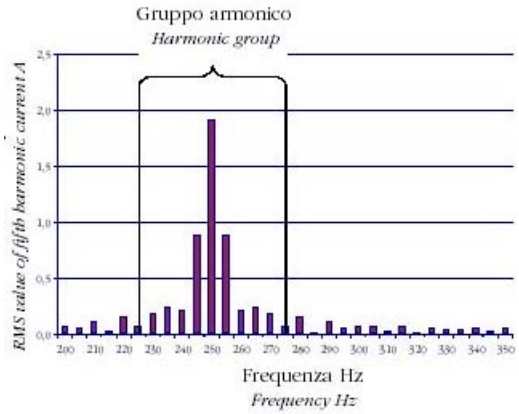
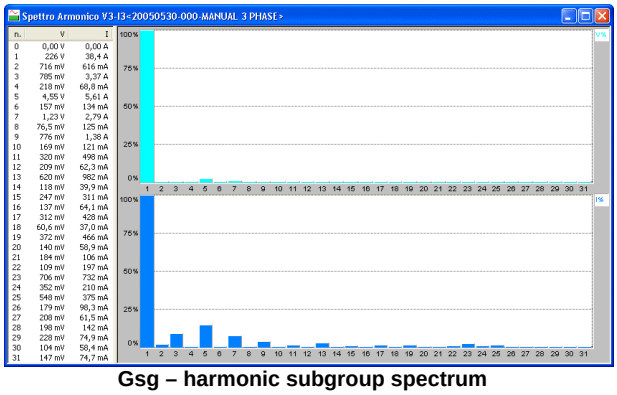


G – harmonic spectrum

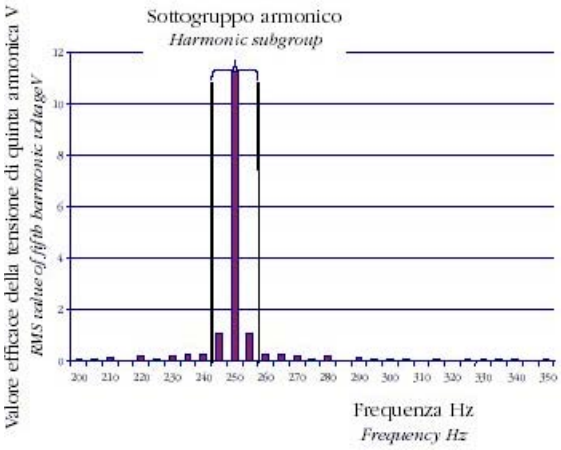


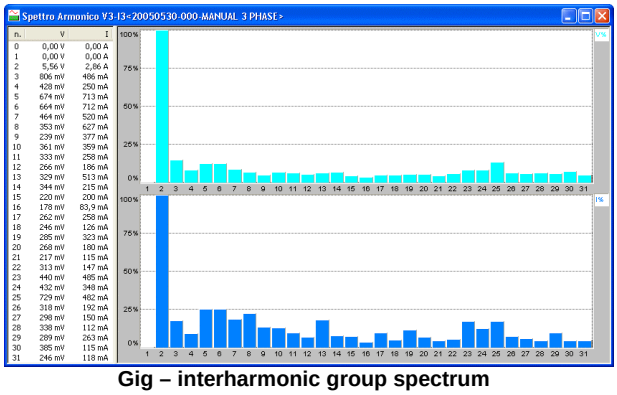
Gg – harmonic group spectrum



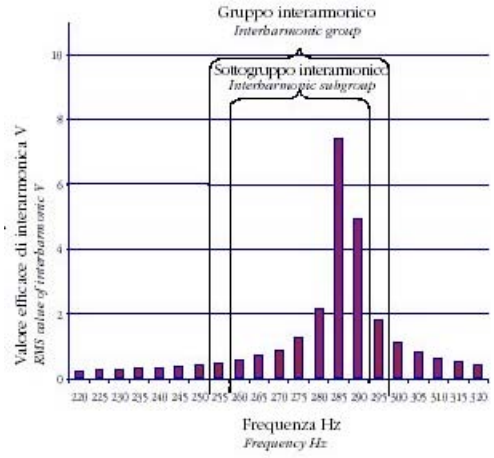


Gsg – harmonic subgroup spectrum





Gig – interharmonic group spectrum



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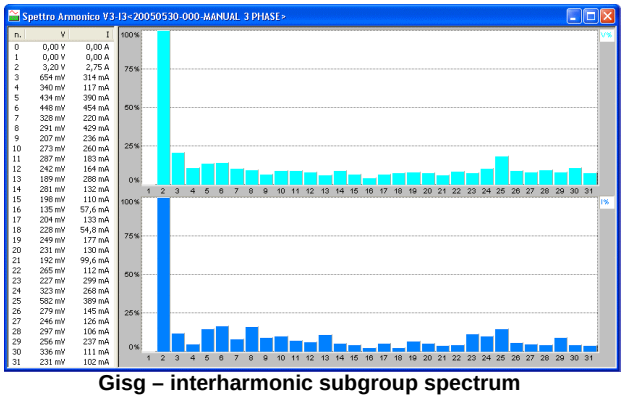
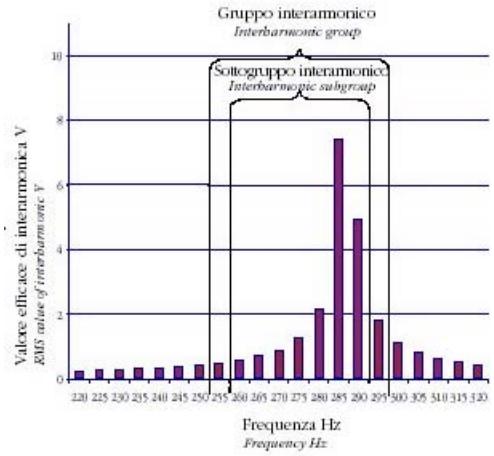
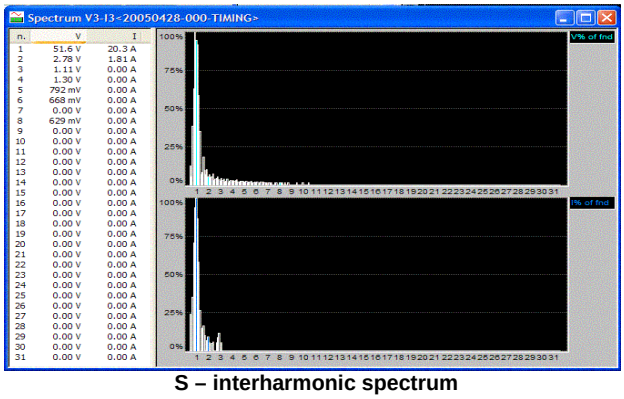
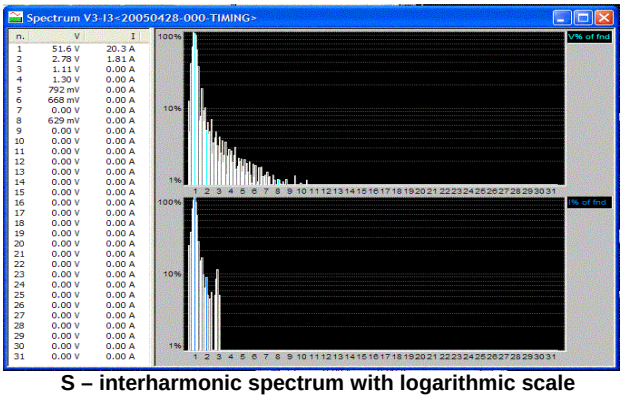


Gisg – interharmonic subgroup spectrum





S – interharmonic spectrum



S – interharmonic spectrum with logarithmic scale

The last two figures display the detailed harmonic spectrum. The coloured bars depict the classic harmonics, whereas the grey bars depict the interharmonics. The frequency for each harmonic order is the multiple of the fundamental frequency; for example, we will have 1st ord.=50Hz, 2nd ord.=100 Hz, 3rd ord.=150Hz and so on for a 50Hz frequency. Similarly, it will be 1st ord.=60Hz, 2nd ord.=120Hz, 3rd ord.=180Hz, etc. for a 60Hz frequency. The interharmonic values, on the other hand, increase in 5Hz steps for a fundamental frequency of 50Hz and in 6Hz steps for a 60Hz fundamental frequency.
If the logarithmic scale is applied (exemplified here in the complete spectrum, but just as valid for any one of the other graphs), we quickly get a magnification of the lowest percentage values. Note how in one case it is at 50%, at half scale, whereas in the other case it is at 10%.

3.1.4 The voltage and current waveforms

Here we have a complete series of views that allow us to observe the waveforms for all of the voltage and current inputs in different combinations in detail. We'll start off explaining the operation by taking a single window as an example. The same concepts are however applicable to all the other windows of this type. A waveform view is nothing other than a small oscilloscope. The control panel is shown on the left side, and on the right are the actual oscillograms. How many and which signals will be displayed will depend on the type of view selected. There are 7 different combinations: V1-V2-V3 star, V1-V2-V3 delta, I1-I2-I3, V1-I1, V2-I2, V3-I3 and I4 (auxiliary channel).

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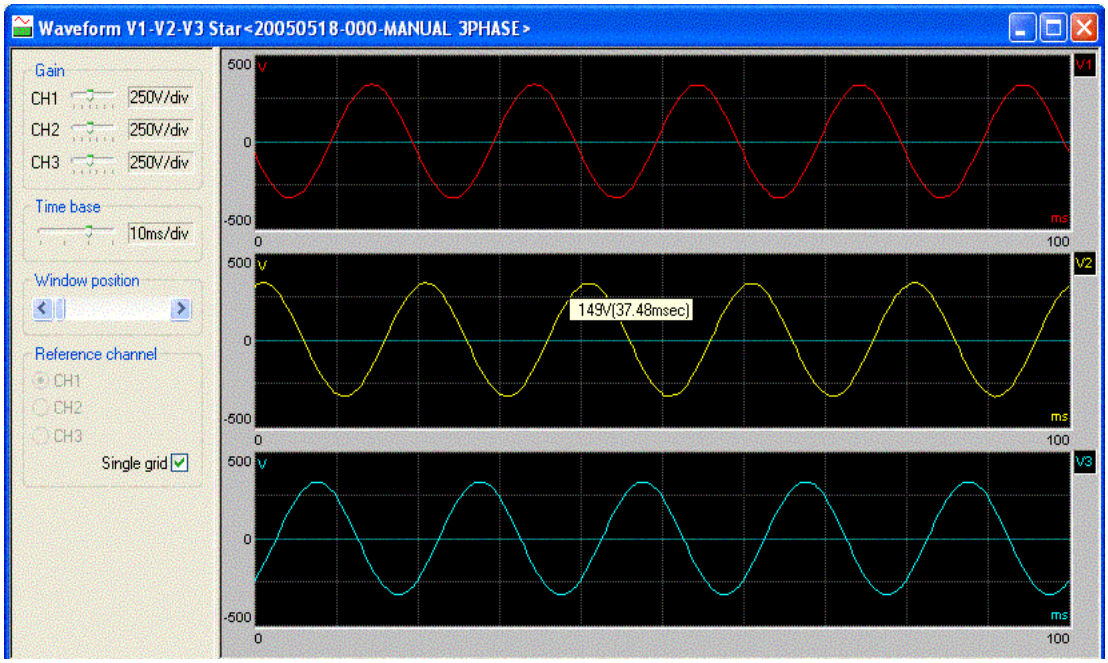
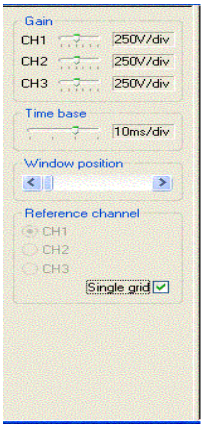
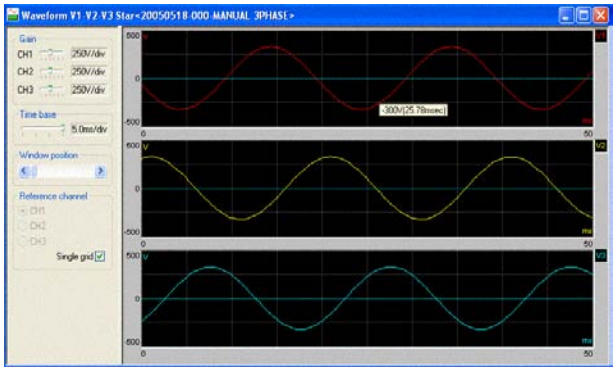
Tel. +39 051 6782006
Fax +39 051 845544
http://www.elcontrol-energy.net
sales@elcontrol-energy.net



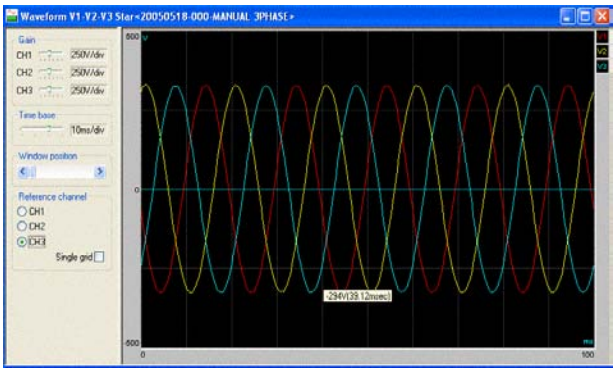


The control panel is made up like this: three switches for changing the gain or amplitude for each channel, a common switch for changing the time base, a scroll bar for positioning the display area or window inside the record (remember that a record is equivalent to 60 periods of the fundamental frequency) and a switch for combining all the channels in a single grid. In this case, it will be necessary to select the corresponding channel in order to be able to use the *Point and Measure* function on a track.

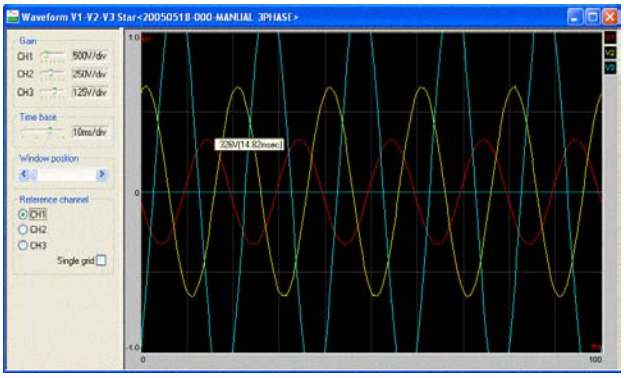
When positioning the cursor on the graphs, the *Point and Measure* function is enabled: if the cursor is left for more than 2 seconds on a certain point of the graphs, a small indicator with the measurement expressed in the units of measure indicated on the vertical and horizontal axes of the system of reference in that point is automatically displayed. In our case the Volts or Amperes and the number of milliseconds will be measured starting from the beginning of the buffer.



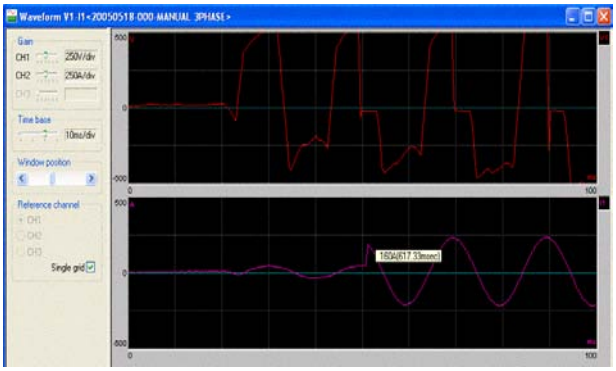
Just use the **Time base** switch to increase or decrease resolution by time units.



All of the channels are grouped together in a single grid when you click on the **Single grid** control.



Just set the **CH1, CH2** or **CH3** switches to increase or decrease the amplitudes of the signals.



Changing the position of the display interval to another point of the record is simple with the **Window position** scroll bar. This option is useful for searching for particular events.

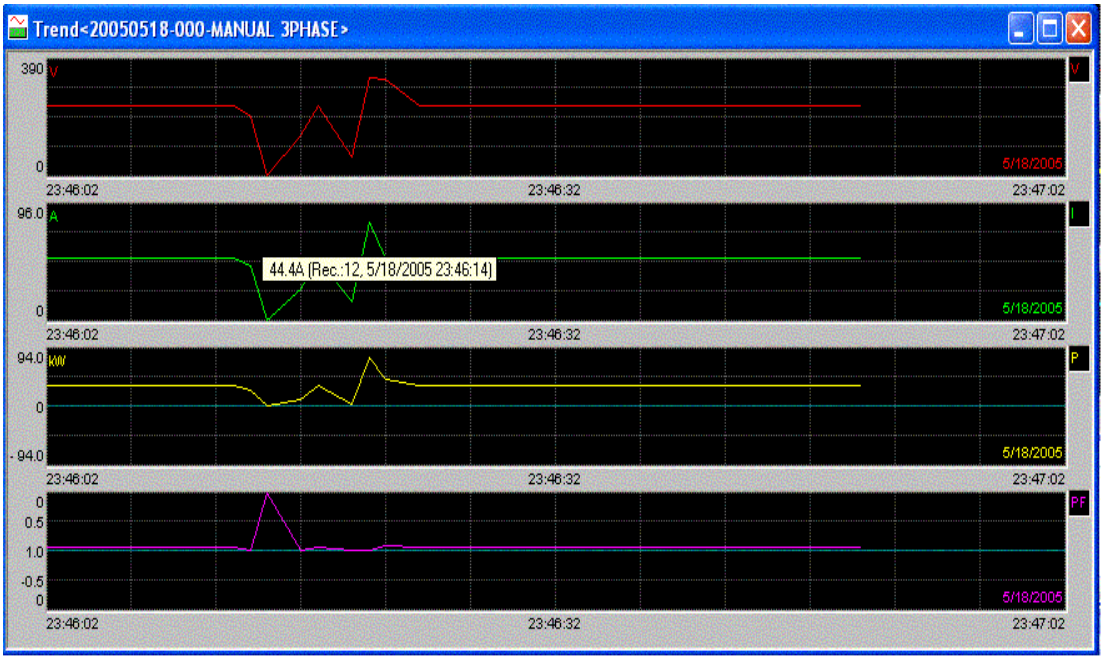
3.1.5 The time trend of the rms measurements

You can enable a function called **trend** for the rms values that lets you plot their trend over time. The figure below represents the default window with the trends of 4 channels: voltage (V), current (I), active power (P) and the three-phase power factor (PF).
In this case the scale factor for the ordinates is automatic, and it keeps the signal always at the maximum resolution (80% of the full scale). As for the x-axis, the following consideration applies: it is fixed and corresponds to 60 samplings expressed in the measuring campaign frequency time. When the frequency time is equal to 0, a value equivalent to 1 second is forced, so the time display window will be 60 x 1 = 60 seconds (1 minute). If, for example, the frequency time were to be 5 minutes, the interval would be equivalent to 60 x 5 = 300 minutes (5 hours).

When the last plotted value exceeds 95% of the display time interval, the tracks are moved to the left, deleting the oldest data, so the displayed data always correspond to the last *60 x sampling time* seconds.

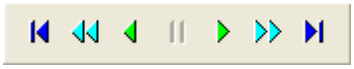
When positioning the cursor on the graphs, the *Point and Measure* function is enabled: if the cursor is left for more than 2 seconds on a certain point of the graphs, a small indicator with the measurement expressed in

the units of measure indicated on the vertical and horizontal axes of the system of reference in that point is automatically displayed.

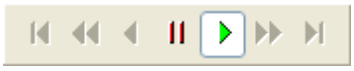


3.1.5.1 Recorder toolbar

When the measurements trend window is displayed during a campaign, the recorder function is enabled. It lets you make the measuring campaign scroll by, creating an animation as if it were a measurement in real time.



It is possible to move to the beginning or end of the recording, and perform a normal or fast forward or rewind. You can momentarily stop execution during reproduction by pressing the **pause** button.

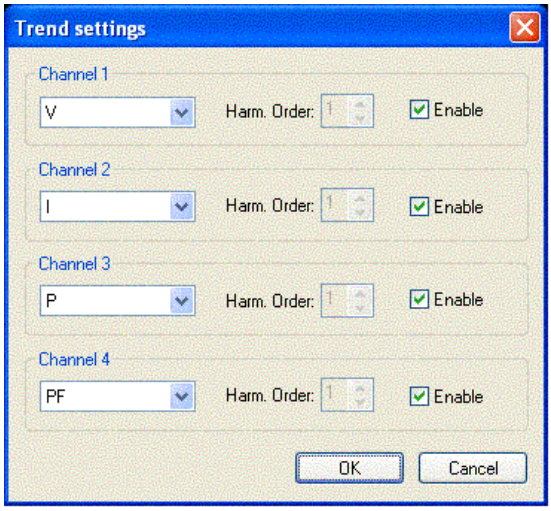


Press the **pause** button again to resume execution of the measurements trend.

If there are other secondary views displayed together with the measurements trend, they will be coupled with the recorder function, i.e. if the trend is paused, so will the other views. When the pause function is enabled, the secondary views display the first record in the display interval of the measurements trend.

3.1.5.2 Setting the number of tracks and the parameter associated with a track

You can customise the number of tracks (or channels) displayed in the trends window and the parameter associated with each track using menu item **Configuration – Trend**:



The number of tracks displayed may vary from a minimum of 1 up to a maximum of 4. Select the box **Enable** to enable/disable a channel. To change the parameter associated with a channel, select it in the box regarding the desired channel. The possible parameters are:

- V
- I
- P
- PF
- Q
- S
- f
- Wh_{abs}
- Wh_{gen}
- $varh_{ind}$
- $varh_{cap}$
- Q Peak
- S Peak
- P Peak
- V (L1)
- V (L2)
- V (L3)
- I (L1)
- I (L2)
- I (L3)
- P (L1)
- P (L2)
- P (L3)
- PF (L1)
- PF (L2)
- PF (L3)
- Q (L1)
- Q (L2)
- Q (L3)
- S (L1)
- S (L2)
- S (L3)
- Avrg. Q
- Avrg. S
- Avrg. P
- Thd ref. V fnd (L1)

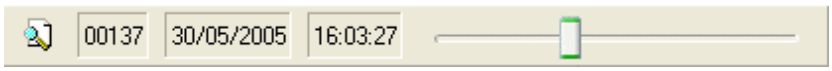
- Thd ref. V rms (L1)
- Thd ref. I fnd (L1)
- Thd ref. I rms (L1)
- Thd ref. V fnd (L2)
- Thd ref. V rms (L2)
- Thd ref. I fnd (L2)
- Thd ref. I rms (L2)
- Thd ref. V fnd (L3)
- Thd ref. V rms (L3)
- Thd ref. I fnd (L3)
- Thd ref. I rms (L3)
- Harm V (L1)
- Harm V% of fnd (L1)
- Harm I (L1)
- Harm I% of fnd (L1)
- Harm Cosphi (L1)
- Harm V (L2)
- Harm V% of fnd (L2)
- Harm I (L2)
- Harm I% of fnd (L2)
- Harm Cosphi (L2)
- Harm V (L3)
- Harm V% of fnd (L3)
- Harm I (L3)
- Harm I% of fnd (L3)
- Harm Cosphi (L3)

Note: when you select a harmonic measurement of V, I or the Cosphi value, you have to specify the harmonic order in the relevant input box.

The changes made are permanent, meaning that the program saves them in the configuration register so as to be able to restore them in the future in another work session.

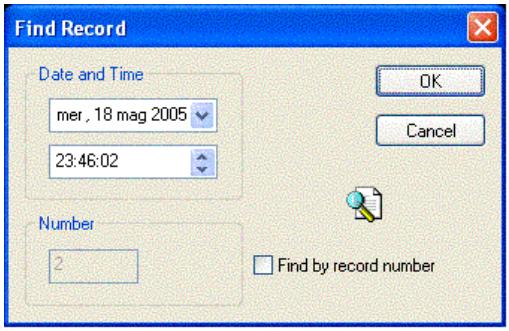
3.1.5.3 Indicators of the current record and random record search

Right under the main menu is a small window indicating the number, date and time of the record currently displayed in the measurements and graphs windows.



While there is a reproduction in progress, the indicators are continuously updated with the information concerning the current record. If the campaign is momentarily put in **pause** status, the window keeps the last values displayed.
On the other hand, the indicators stay empty when just the measurements are displayed unless you enter the **pause** status and use the recorder function.

You can position yourself on any point of the measuring campaign with the **Find Record** function. When you press the button located to the left of the indicators, a window like this one is displayed:

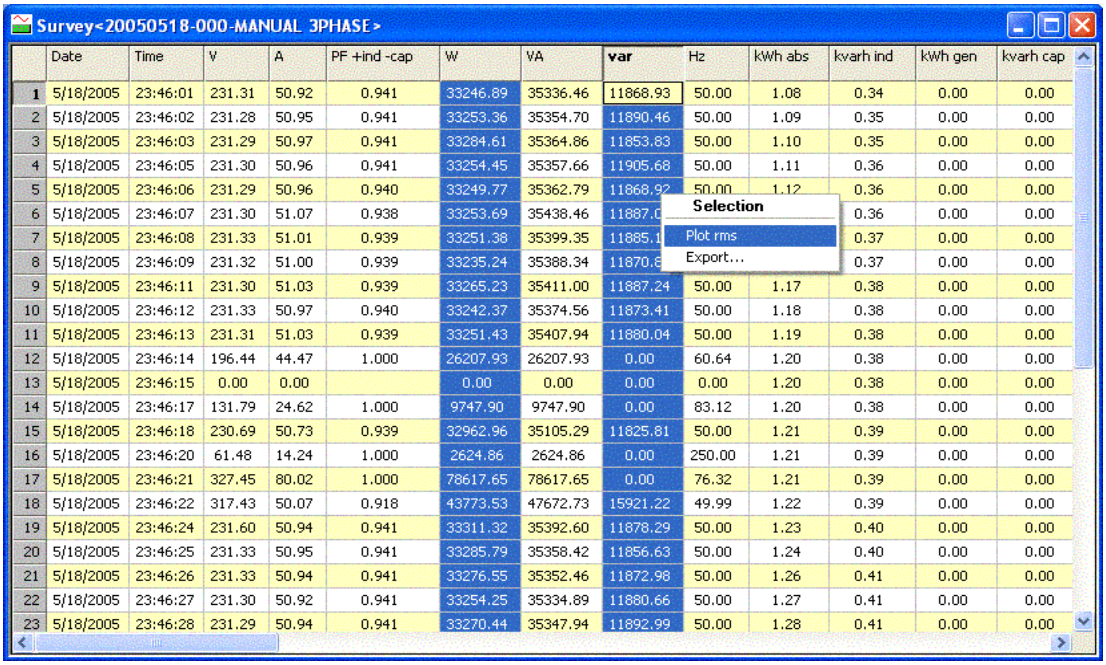


Set the date and time of the desired record and press **OK**. Positioning is also possible based on the corresponding number of the record. To do this, select the box *Find by record no.*, enter the desired record number and press **OK**. Now all of the windows with the displayed measurements and graphs will be updated to the set record.

Lastly, there is a scroll control on the right for quick moves.

3.1.6 Grid with rms measurements in Excel style

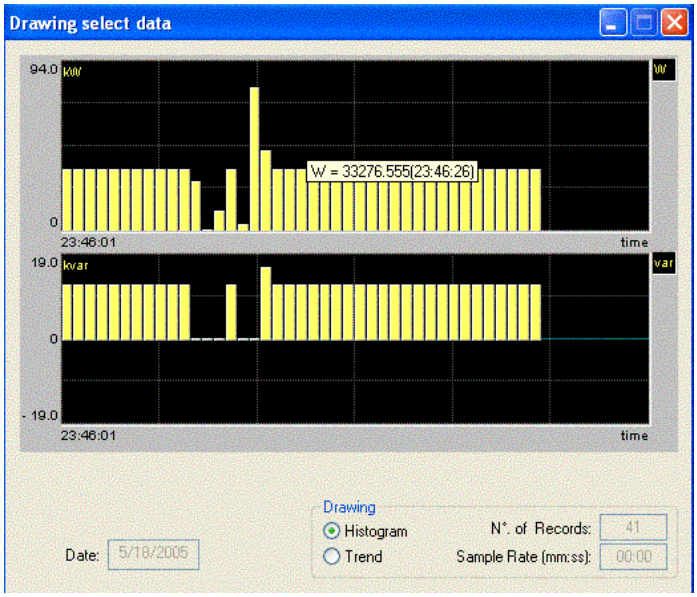
By selecting menu item **View – Records**, a window containing a grid in Excel style is displayed. Its lines represent the campaign's records in chronological order, whereas every column contains the rms value of the parameter shown in the first line.



	Date	Time	V	A	PF +ind -cap	W	VA	var	Hz	kWh abs	kvarh ind	kWh gen	kvarh cap
1	5/18/2005	23:46:01	231.31	50.92	0.941	33246.89	35336.46	11868.93	50.00	1.08	0.34	0.00	0.00
2	5/18/2005	23:46:02	231.28	50.95	0.941	33253.36	35354.70	11890.46	50.00	1.09	0.35	0.00	0.00
3	5/18/2005	23:46:03	231.29	50.97	0.941	33284.61	35364.86	11853.83	50.00	1.10	0.35	0.00	0.00
4	5/18/2005	23:46:05	231.30	50.96	0.941	33254.45	35357.66	11905.68	50.00	1.11	0.36	0.00	0.00
5	5/18/2005	23:46:06	231.29	50.96	0.940	33249.77	35362.79	11868.92	50.00	1.12	0.36	0.00	0.00
6	5/18/2005	23:46:07	231.30	51.07	0.938	33253.69	35438.46	11887.0			0.36	0.00	0.00
7	5/18/2005	23:46:08	231.33	51.01	0.939	33251.38	35399.35	11885.1			0.37	0.00	0.00
8	5/18/2005	23:46:09	231.32	51.00	0.939	33235.24	35388.34	11870.6			0.37	0.00	0.00
9	5/18/2005	23:46:11	231.30	51.03	0.939	33265.23	35411.00	11887.24	50.00	1.17	0.38	0.00	0.00
10	5/18/2005	23:46:12	231.33	50.97	0.940	33242.37	35374.56	11873.41	50.00	1.18	0.38	0.00	0.00
11	5/18/2005	23:46:13	231.31	51.03	0.939	33251.43	35407.94	11880.04	50.00	1.19	0.38	0.00	0.00
12	5/18/2005	23:46:14	196.44	44.47	1.000	26207.93	26207.93	0.00	60.64	1.20	0.38	0.00	0.00
13	5/18/2005	23:46:15	0.00	0.00		0.00	0.00	0.00	0.00	1.20	0.38	0.00	0.00
14	5/18/2005	23:46:17	131.79	24.62	1.000	9747.90	9747.90	0.00	83.12	1.20	0.38	0.00	0.00
15	5/18/2005	23:46:18	230.69	50.73	0.939	32962.96	35105.29	11825.81	50.00	1.21	0.39	0.00	0.00
16	5/18/2005	23:46:20	61.48	14.24	1.000	2624.86	2624.86	0.00	250.00	1.21	0.39	0.00	0.00
17	5/18/2005	23:46:21	327.45	80.02	1.000	78617.65	78617.65	0.00	76.32	1.21	0.39	0.00	0.00
18	5/18/2005	23:46:22	317.43	50.07	0.918	43773.53	47672.73	15921.22	49.99	1.22	0.39	0.00	0.00
19	5/18/2005	23:46:24	231.60	50.94	0.941	33311.32	35392.60	11878.29	50.00	1.23	0.40	0.00	0.00
20	5/18/2005	23:46:25	231.33	50.95	0.941	33285.79	35358.42	11856.63	50.00	1.24	0.40	0.00	0.00
21	5/18/2005	23:46:26	231.33	50.94	0.941	33276.55	35352.46	11872.98	50.00	1.26	0.41	0.00	0.00
22	5/18/2005	23:46:27	231.30	50.92	0.941	33254.25	35334.89	11880.66	50.00	1.27	0.41	0.00	0.00
23	5/18/2005	23:46:28	231.29	50.94	0.941	33270.44	35347.94	11892.99	50.00	1.28	0.41	0.00	0.00

3.1.6.1 Making a graph of a set of measurements

You can select from one to four parameters (columns) for a maximum of 5000 records with the mouse; then the measurements selected will be graphically represented in just as many oscilloscope type of quadrants contained in a new window when you select the option **Make rms graph** from the contextual **Selection** menu. In this context it is possible to change the way of plotting the measurements: from histogram to trend and vice versa. If the number of selected records is greater than the quadrant's graphic capability, you can actuate scrolling of the parameters shown in both directions using the buttons found in the lower left-hand corner (**<** and **>**).



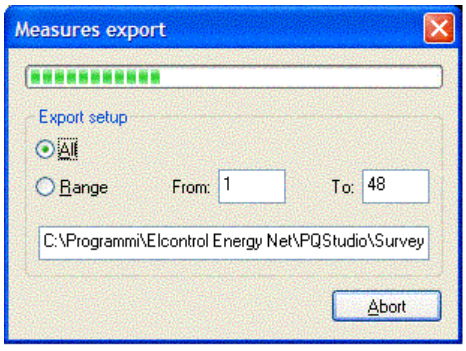
Moreover, this window shows fields that give, respectively:

- the date of the records currently depicted in the oscillogram;
- the total number of selected records;
- the recording frequency of the records (Frequency).

The recording times of the first and last record currently shown on the graph are shown at the ends of the quadrant's abscissa. When positioning the cursor on the graphs, the *Point and Measure* function is enabled: if the cursor is left for more than 2 seconds on a certain point of the graphs, a small indicator with the measurement expressed in the units of measure indicated on the vertical and horizontal axes of the system of reference in that point is automatically displayed.

3.1.6.2 Exporting a set of measurements

To export data, select the records to be exported with the mouse, press the right mouse button and then select the option **Export…** from the contextual **Selection** menu. The records in the selected range will be automatically exported while displaying a window of this type:

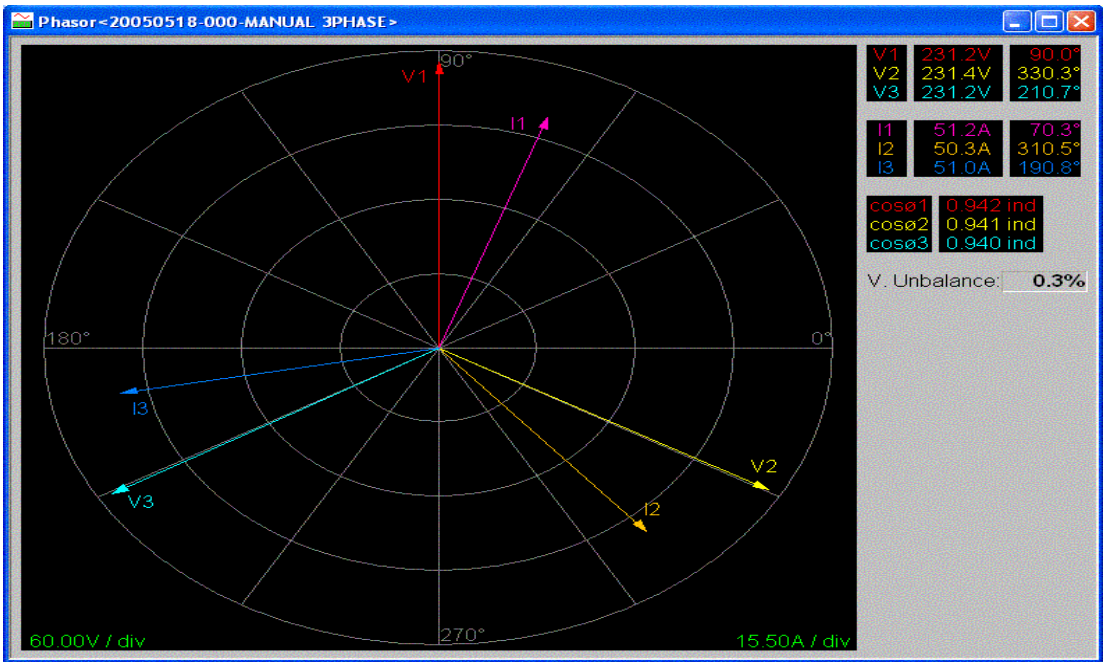


For more details, consult the paragraph 3.1.8.

3.1.7 The vector meter

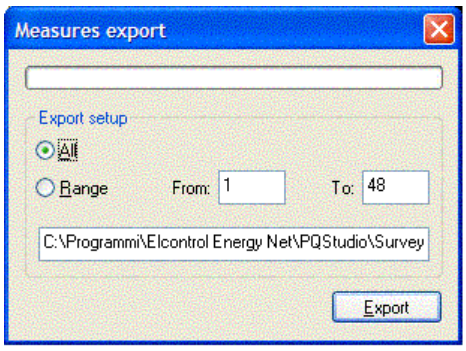
The fundamental parameters of the voltages (between phase and neutral) and of the currents are depicted on this page in vector mode, i. e. in module and phase. The panel on the right side of the graph lists the voltages and currents with the respective modules and phase angles, and farther down the cosine of the

phase angle between V1-I1, V2-I2 and V3-I3 with the relevant indication of the type of load: inductive or capacitive. Lastly, the unbalance of the three-phase voltage system expressed in a percentage is displayed. Values close to 0% indicate a balanced system.

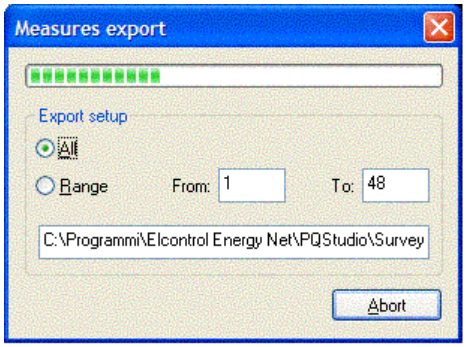


3.1.8 Exporting the measurements into a text file

You can export the data recorded in a measuring campaign into a text file, which can later be imported by other data processing programs like Excel, for example.
Select menu item **File – Export** to start the export. A window where you can set the export mode (part or all of the measuring campaign) and the export interval expressed in number of records is displayed.



To export the entire campaign, select **All** and press **Export**. If, on the other hand, you want to export just a part, select **Interval**, set the first record number (in the box **From:**) and last record number (in the box **To:**), and then press **Export**. *Tip*: use the grid view of the measurements in Excel style (**View – Records**) to identify the number of the records of the desired export interval.



Progress is displayed during export, and the **Export** button becomes **Stop**. The operation may even last a few minutes, depending on the type of campaign and its duration. You may however stop its process at any time by pressing the **Stop** button.

The export files are created in the directory indicated in the relevant input box. The directory where the measuring campaign resides is presented by default. The export files are divided into four types and can be distinguished based on their file extensions:

- **.M***XXX*: file with the same rms measurements contained in the Excel style of grid. *XXX* is a progressive number from 000 to 999, and is used in subdividing a very long campaign;
- **.A***XXX*: file with the measurements of V and I and of the Cosphi value from the 1st to the 31st harmonic for each phase in *absolute* value. *XXX* is a progressive number from 000 to 999, and is used in subdividing a very long campaign;
- **.P***XXX*: file with the measurements of V and I and of the Cosphi value from the 1st to the 31st harmonic for each phase in *percentage* value. *XXX* is a progressive number from 000 to 999, and is used in subdividing a very long campaign;
- **.W***XXX*: file with the samples of the waveforms of V and I for each phase. *XXX* is a progressive number from 000 to 999, and is used in subdividing a very long campaign.

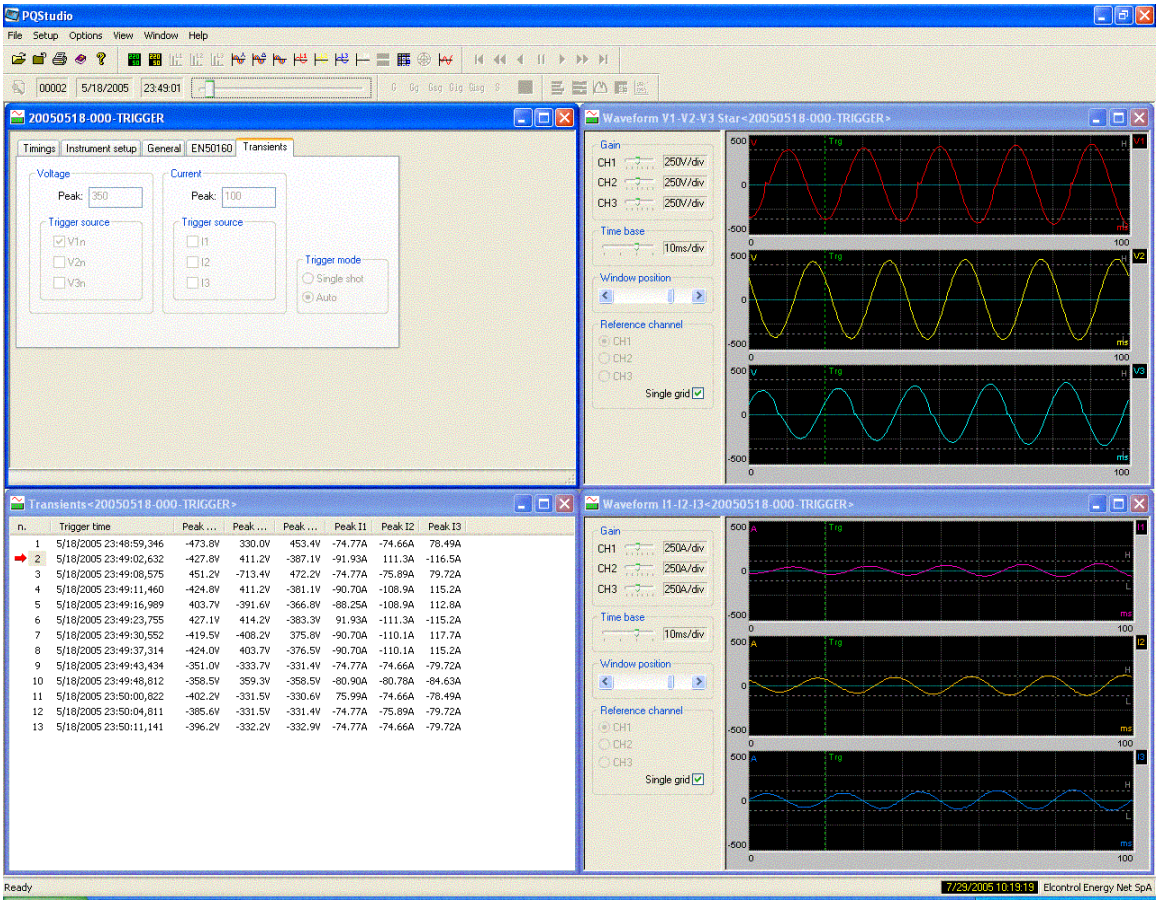
The character used as the field separator is **Tab** (ASCII code 09).

For the first three files, every line corresponds to a record of the measuring campaign, whereas every column contains the amplitude measurement value indicated in the first line. On the other hand, every record is saved on six lines for the file with export of the samples: the first three correspond to the voltages (V1, V2 and V3), and the second three to the currents (I1, I2 and I3). Owing to the nature of this export, the resulting file may come large in size. It is therefore recommended to make several partial exports.

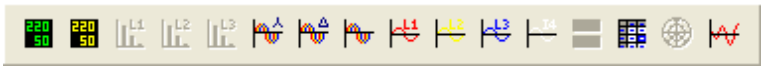
3.2 Transients Campaign

As you can see, the campaign configuration window as well as the other graphic views are perfectly similar to those already described for the Timed type of campaign.

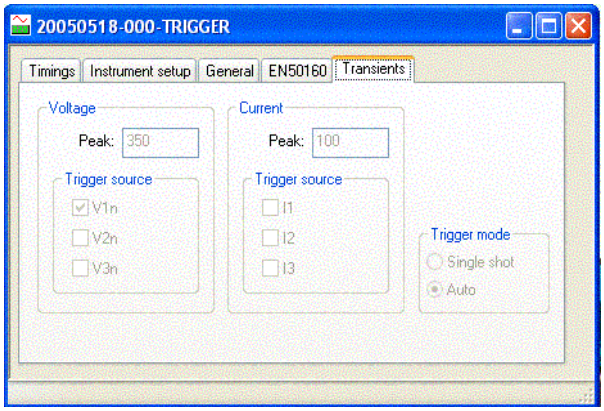
The differences are minimum and regard a supplementary view with the list of overvoltage and overcurrent events detected during analysis of the system. Moreover, some broken lines (one vertical and two horizontal) have been added in the oscillograms. They depict the instant and the minimum and maximum trigger thresholds, meant as a symmetrical peak value compared to the neutral.



The **View** menu and the toolbar now change appearance, adapting themselves to this type of campaign: the spectrum analysis, trend and vector meter are no longer available. A new button tied to the window with the list of the events previously mentioned is however enabled.



In going back to the configuration window, the peak value set as the trigger threshold is given in the **Transients** card together with the trigger sources for the voltages and currents.



These trigger sources can be enabled singly or together. One important feature of this type of campaign is that events captured with trigger thresholds and different sources can coexist in the same record. So every event is accompanied by the parameters with which it was detected, and this information will be updated on this card at the time it is displayed. Lastly, the trigger mode set during the campaign is given:

- *Single*: the event is made up of just one record, regardless of the phenomenon's duration
- *Automatic*: the event is made up of one or more records that completely contain the entire phenomenon

3.2.1 The rms measurements

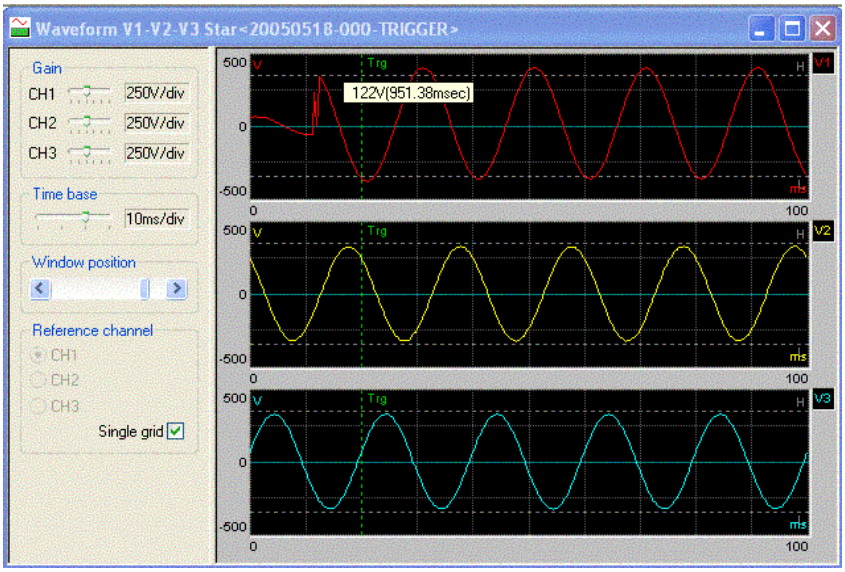
See paragraph 3.1.1.

3.2.2 The THD measurements

See paragraph 3.1.2.

3.2.3 The voltage and current waveforms

Some broken lines (one vertical and two horizontal) have been added in the oscillograms. They depict the instant and the minimum and maximum trigger thresholds, meant as a symmetrical peak value compared to the neutral. When the events in the list of transients are skimmed through, the record interval containing the trigger instant is always displayed. The duration of this interval depends on the time base set on the control panel to the left of the oscillograms. If the outline conditions so permit, at least the 20ms preceding the trigger instant are displayed.



The same characteristics described in paragraph 3.1.4 apply to the remainder.

3.2.4 Grid with rms measurements in Excel style

See paragraph 3.1.6.

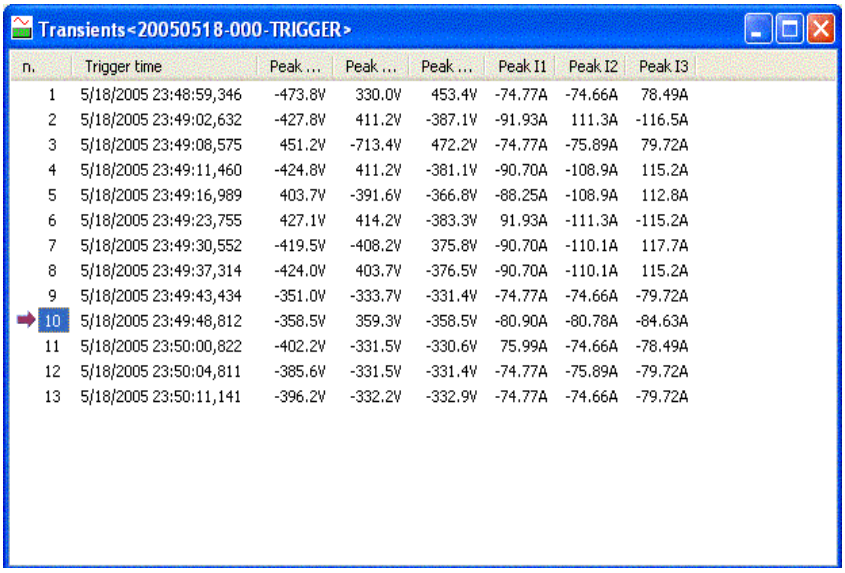
3.2.5 The transients list

All of the events recorded during the measuring campaign are shown in a list in chronological order. Every line corresponds to a different transient. The progressive number of the event, the date and time including the milliseconds of the trigger instant, and a set of six values with the maximum voltage and current peaks

detected during the entire manifestation of the phenomenon are listed in the columns. These values are therefore not to be confused with the peak value that caused the trigger event.

By clicking on the first column – the one with the progressive numbers of the transients – you select the event you want to view (it will be highlighted with a small red arrow). All of the other views will be immediately synchronised with the relative information, including the control window where the configuration parameters are given. You can also skim through the list using the keyboard (up arrow, down arrow) and the scroll control found in the toolbar.

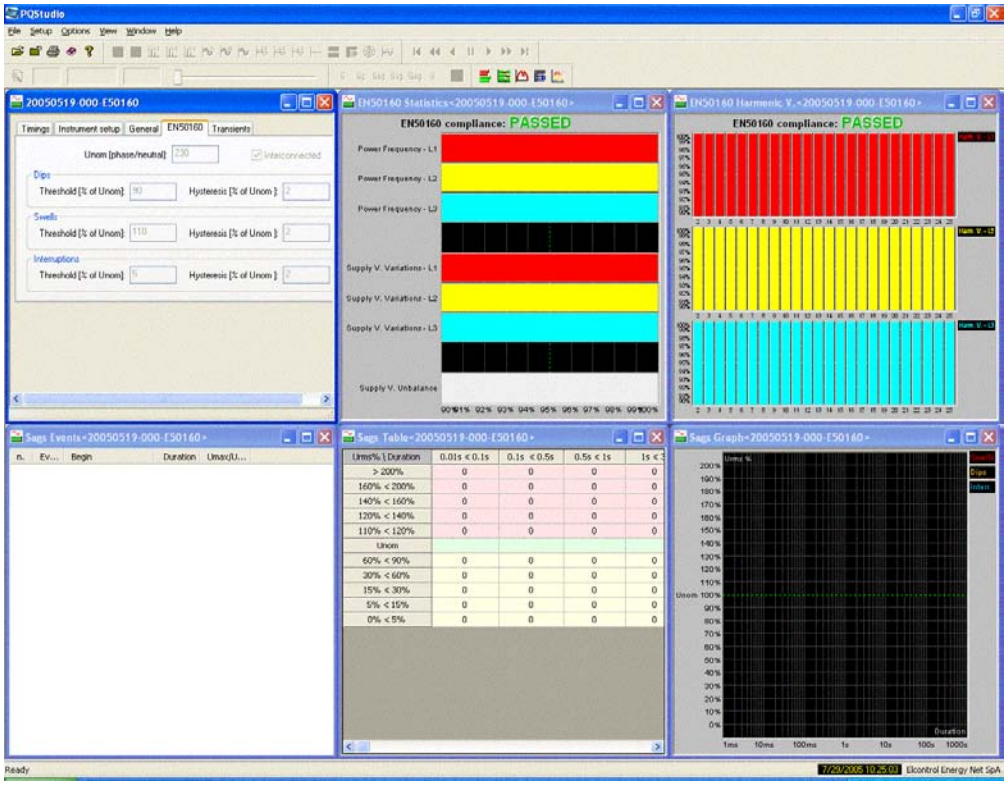
The records with information about the samples are saved in sequence. Indication of the current record may not coincide with the progressive number of the transient, above all if there are events captured in the *Automatic* trigger mode.



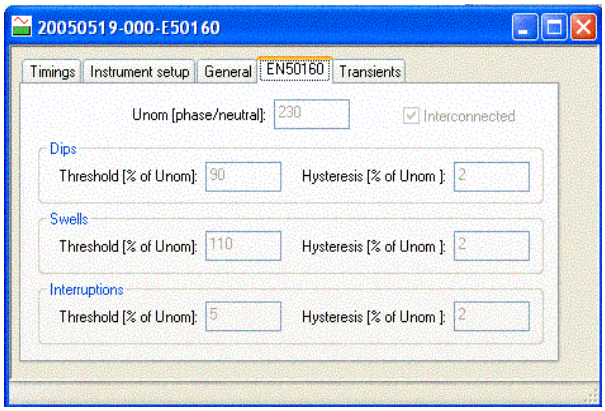
n.	Trigger time	Peak ...	Peak ...	Peak ...	Peak I1	Peak I2	Peak I3
1	5/18/2005 23:48:59,346	-473.8V	330.0V	453.4V	-74.77A	-74.66A	78.49A
2	5/18/2005 23:49:02,632	-427.8V	411.2V	-387.1V	-91.93A	111.3A	-116.5A
3	5/18/2005 23:49:08,575	451.2V	-713.4V	472.2V	-74.77A	-75.89A	79.72A
4	5/18/2005 23:49:11,460	-424.8V	411.2V	-381.1V	-90.70A	-108.9A	115.2A
5	5/18/2005 23:49:16,989	403.7V	-391.6V	-366.8V	-88.25A	-108.9A	112.8A
6	5/18/2005 23:49:23,755	427.1V	414.2V	-383.3V	91.93A	-111.3A	-115.2A
7	5/18/2005 23:49:30,552	-419.5V	-408.2V	375.8V	-90.70A	-110.1A	117.7A
8	5/18/2005 23:49:37,314	-424.0V	403.7V	-376.5V	-90.70A	-110.1A	115.2A
9	5/18/2005 23:49:43,434	-351.0V	-333.7V	-331.4V	-74.77A	-74.66A	-79.72A
10	5/18/2005 23:49:48,812	-358.5V	359.3V	-358.5V	-80.90A	-80.78A	-84.63A
11	5/18/2005 23:50:00,822	-402.2V	-331.5V	-330.6V	75.99A	-74.66A	-78.49A
12	5/18/2005 23:50:04,811	-385.6V	-331.5V	-331.4V	-74.77A	-75.89A	-79.72A
13	5/18/2005 23:50:11,141	-396.2V	-332.2V	-332.9V	-74.77A	-74.66A	-79.72A

3.3 EN50160 Campaign

An analysis of the quality of the electrical energy according to the EN50160 regulations is conducted with this type of record. It concerns the frequency, changes in voltage, losses of voltage, overvoltages between phase-to-phase, short and long interruptions, power supply unbalance and the harmonic spectrum of the voltage.



As for the other types of campaign, there is a main window that gives all the data regarding the instrument's configuration status. The EN50160 card displays the parameters set by the user for carrying out the analysis and hence of the campaign.
Please refer to the JUPITER electrical energy quality analyser manual for more detailed explanations regarding the analysis limits and criteria.

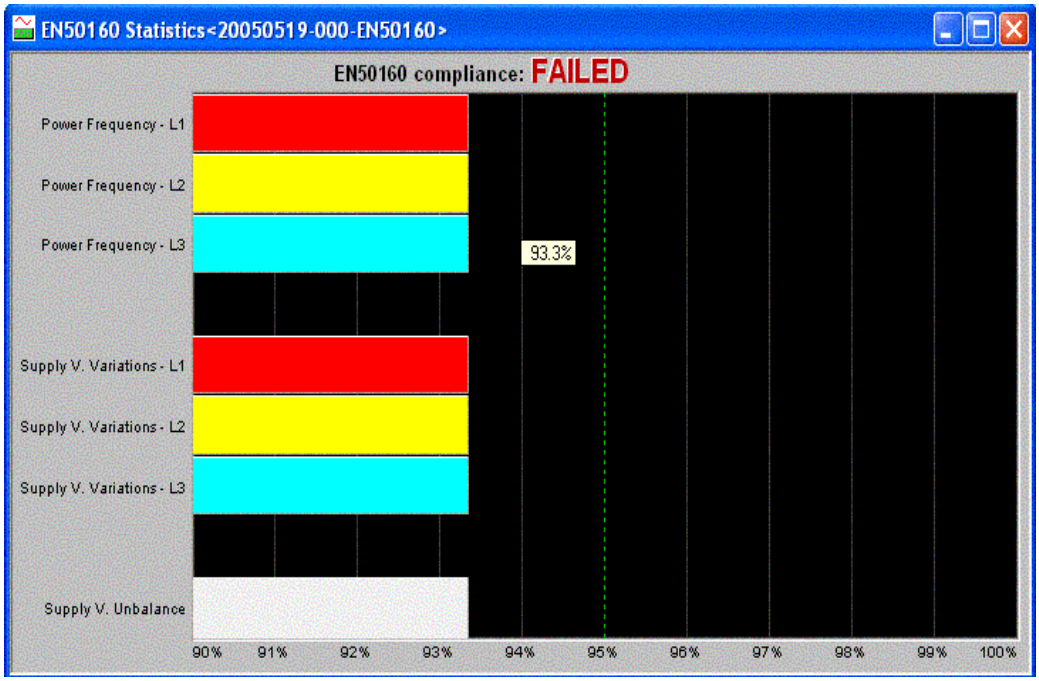


The **View** menu and toolbars set themselves up for the campaign in question. You can note that now five new views and a brand-new control bar appear.

3.3.1 EN50160 conformity: frequency, changes and voltage unbalance

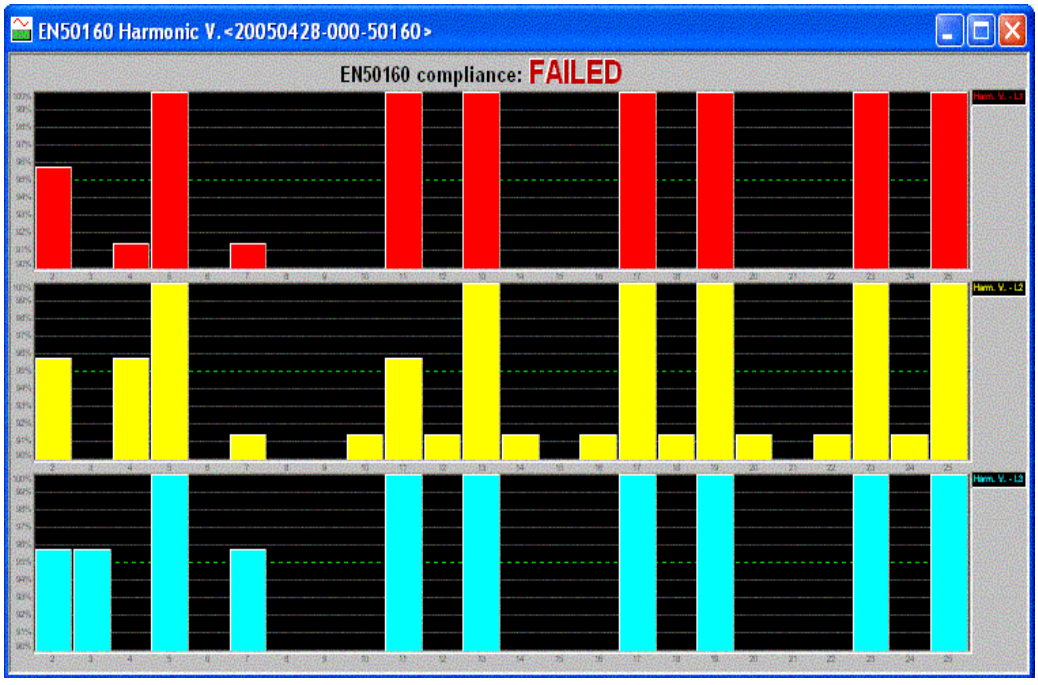
Here the result of the analysis concerning the time percentage referring to the duration of the entire campaign is represented, for which the frequency values, averaged over 10 seconds, remain within the tolerance threshold established by the regulations (95%). The same applies to the changes and the power supply voltage unbalance, however with an integration time equivalent to 10 minutes. If one of the

parameters does not fall within the 95% threshold, the **NOT PASSED** message is given. To the contrary, the **PASSED** message is given only when all parameters pass it.



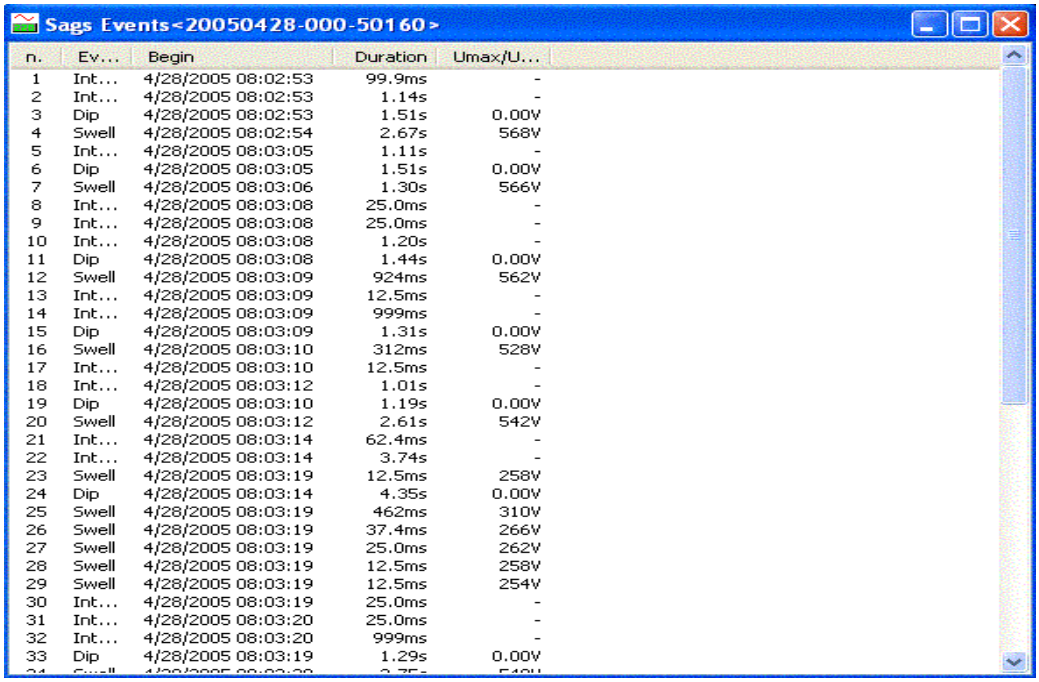
3.3.2 EN50160 conformity: harmonic voltage

The analysis is carried out on the harmonic distortion values of the voltages referring to the fundamental for each one of the three phases. Also in this case the values are averaged over 10 minutes and the threshold is 95% of the time referring to the total recording duration. If one of the parameters does not fall within the 95% threshold, the **NOT PASSED** message is given. To the contrary, the **PASSED** message is given only when all parameters pass it.



3.3.3 List of SAGS events

A chronologically ordered list contains all of the SAGS events recorded in the measuring campaign. There can be three types: interruptions, losses of voltage (Dip) or overvoltage (Swell). Every line depicts a different event and is characterised by the type, the starting instant, the duration, and possibly by the maximum or residual voltage value expressed in absolute value. By clicking on the buttons in the title bar, you call up the event sorting function. You sort in increasing order with the first click, and in decreasing order with the second click.

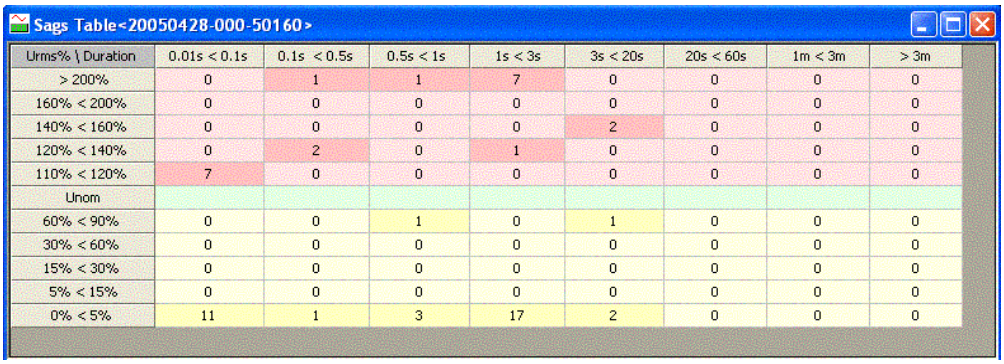


Sags Events<20050428-000-50160>

n.	Ev...	Begin	Duration	Umax/U...
1	Int...	4/28/2005 08:02:53	99.9ms	-
2	Int...	4/28/2005 08:02:53	1.14s	-
3	Dip	4/28/2005 08:02:53	1.51s	0.00V
4	Swell	4/28/2005 08:02:54	2.67s	568V
5	Int...	4/28/2005 08:03:05	1.11s	-
6	Dip	4/28/2005 08:03:05	1.51s	0.00V
7	Swell	4/28/2005 08:03:06	1.30s	566V
8	Int...	4/28/2005 08:03:08	25.0ms	-
9	Int...	4/28/2005 08:03:08	25.0ms	-
10	Int...	4/28/2005 08:03:08	1.20s	-
11	Dip	4/28/2005 08:03:08	1.44s	0.00V
12	Swell	4/28/2005 08:03:09	924ms	562V
13	Int...	4/28/2005 08:03:09	12.5ms	-
14	Int...	4/28/2005 08:03:09	999ms	-
15	Dip	4/28/2005 08:03:09	1.31s	0.00V
16	Swell	4/28/2005 08:03:10	312ms	528V
17	Int...	4/28/2005 08:03:10	12.5ms	-
18	Int...	4/28/2005 08:03:12	1.01s	-
19	Dip	4/28/2005 08:03:10	1.19s	0.00V
20	Swell	4/28/2005 08:03:12	2.61s	542V
21	Int...	4/28/2005 08:03:14	62.4ms	-
22	Int...	4/28/2005 08:03:14	3.74s	-
23	Swell	4/28/2005 08:03:19	12.5ms	258V
24	Dip	4/28/2005 08:03:14	4.35s	0.00V
25	Swell	4/28/2005 08:03:19	462ms	310V
26	Swell	4/28/2005 08:03:19	37.4ms	266V
27	Swell	4/28/2005 08:03:19	25.0ms	262V
28	Swell	4/28/2005 08:03:19	12.5ms	258V
29	Swell	4/28/2005 08:03:19	12.5ms	254V
30	Int...	4/28/2005 08:03:19	25.0ms	-
31	Int...	4/28/2005 08:03:20	25.0ms	-
32	Int...	4/28/2005 08:03:20	999ms	-
33	Dip	4/28/2005 08:03:19	1.29s	0.00V

3.3.4 SAGS events table

This is another SAGS display mode. A set of time and voltage intervals is defined in a two-dimensional table. The voltage intervals are expressed in percentage referring to the rated Unom voltage. Every box is increased by a unit when a certain event is comprised within the duration and voltage value interval depicted by that particular box. In this way we get a mapping with the density of the SAGS events.



Sags Table<20050428-000-50160>

Urms% \ Duration	0.01s < 0.1s	0.1s < 0.5s	0.5s < 1s	1s < 3s	3s < 20s	20s < 60s	1m < 3m	> 3m
> 200%	0	1	1	7	0	0	0	0
160% < 200%	0	0	0	0	0	0	0	0
140% < 160%	0	0	0	0	2	0	0	0
120% < 140%	0	2	0	1	0	0	0	0
110% < 120%	7	0	0	0	0	0	0	0
Unom								
60% < 90%	0	0	1	0	1	0	0	0
30% < 60%	0	0	0	0	0	0	0	0
15% < 30%	0	0	0	0	0	0	0	0
5% < 15%	0	0	0	0	0	0	0	0
0% < 5%	11	1	3	17	2	0	0	0

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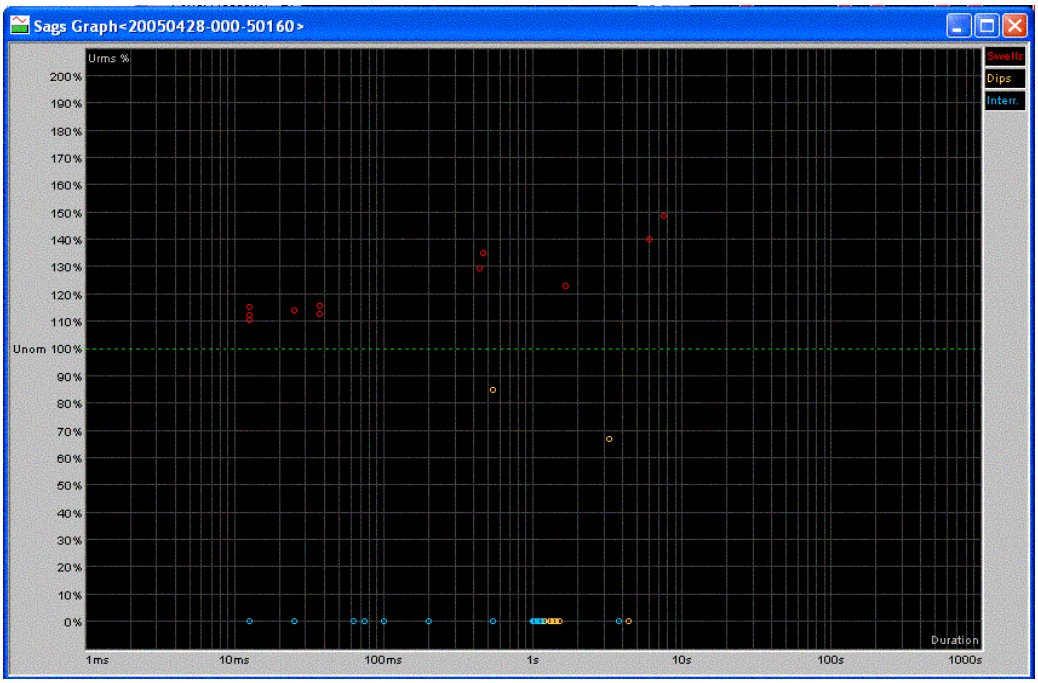
3.3.5 SAGS array graph

In this case it is a graphic display of the distribution of the events taken into consideration. Every coloured dot symbolises a different event. We can therefore identify the different areas populated with anomalous phenomena with a simple visual analysis. The duration scale is represented in logarithmic scale in order to cover an extensive time interval. The values are comprised between 1 thousandth of a second and 1000 seconds (16.6 minutes).



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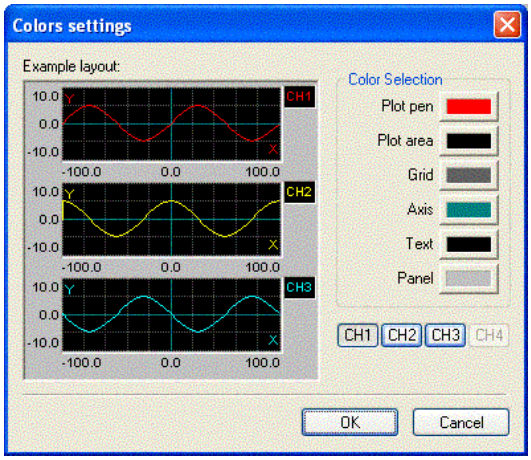
4 Customising the graph colours

If you want to change the default setting of the graph colours, click on any point of the graph with the right mouse button or select the menu item **Options – Colours**. A window that lets you freely select the colours of the different areas of the oscillogram appears, such as: panel colour, track colour, pen colour, etc. *Note*: the same number of tracks of the graph that you are configuring is given on the colour configuration window. Depending on the case at hand, it may be a number from 1 to 4.



- Select the channel you want to configure by pressing the button CH1, CH2, CH3 or CH4.
- Select the area whose colour you want to change by pressing one of the buttons found in the **Colour selection** group. A window like this appears:

- Select the desired colour and press **OK**.
- Repeat the preceding steps for the other areas to be modified.
- Lastly, press the **OK** button in the configuration window of the graph colours. The changes made will be shown on the original graph.

5 Printing documents

The program lets you print all of the measurements and previously illustrated graphs on both black and white and colour printers for paper filing and for filling in system analysis reports.
You can print with the paper in either portrait or landscape orientation, without distinction. It is also possible to get a print preview on the screen for all prints before actually printing. The printer management criterion is the Windows environment standard.

The print preview and print refer to the currently selected window, i.e. the one in the foreground characterised by the active title bar. So before printing, click on the desired window or select it using the Window command of the main menu.

A few print examples are shown below:

5.1 Information about the measuring campaign

Elcontrol Energy Net SpA MANUAL 3 PHASE PQStudio

Informazione campagna

Nome	MANUAL 3 PHASE
Note	
Ora d'inizio	lunedì 30 maggio 2005 16.00.45
Ora di fine	lunedì 30 maggio 2005 16.08.14
Cadenza (mm:ss)	00:00
Records	376
Modo	Manual
Stato	ESEGUITA
Tipo	Forma d'onda

Configurazione dello strumento

Strumento	JUPITER
Versione	SW: 0.00.01.01 - FW: 0.01 - SN:11100123
Rapporto PT	100V / 100V
Rapporto CT	500A (Flex)
Rapporto AUX	1,00kA / 1,00V
Analisi Armonica	50Hz
Inserzione	Quattro fili
Unom [fase/neutro]	230V
Interconnesso	ON
Soglia Dip [% Unom]	90%
Isteresi Dip [% Unom]	2%
Soglia Swell [% Unom]	110%
Isteresi Swell [% Unom]	2%
Soglia Interruzione [% Unom]	5%
Isteresi Interruzione [% Unom]	2%
Sovratensione	380V
Sovracorrente	100A
Modo trigger	Single shot
Sorgente(i) trigger	

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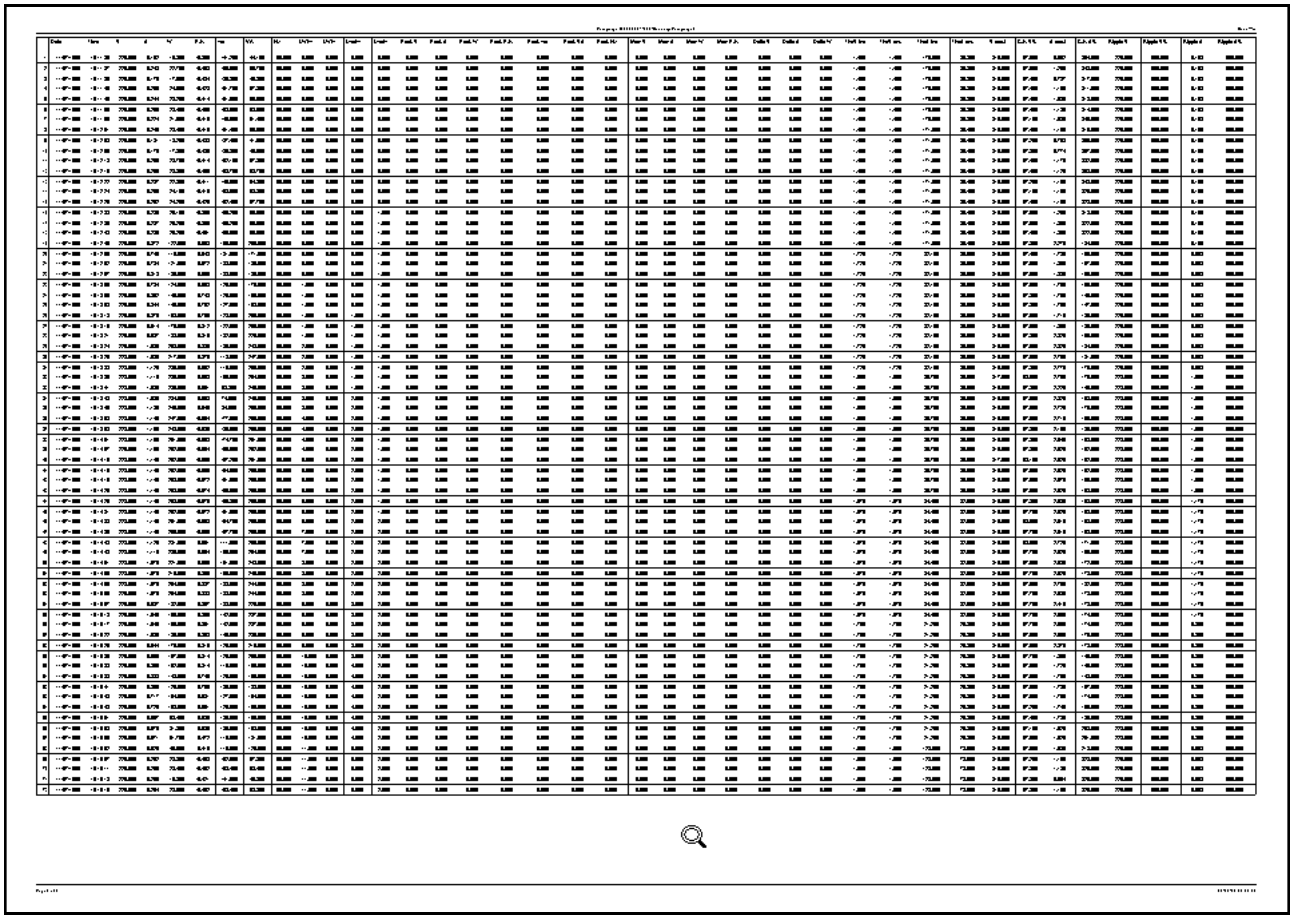
5.2 Grid with rms measurements in Excel style



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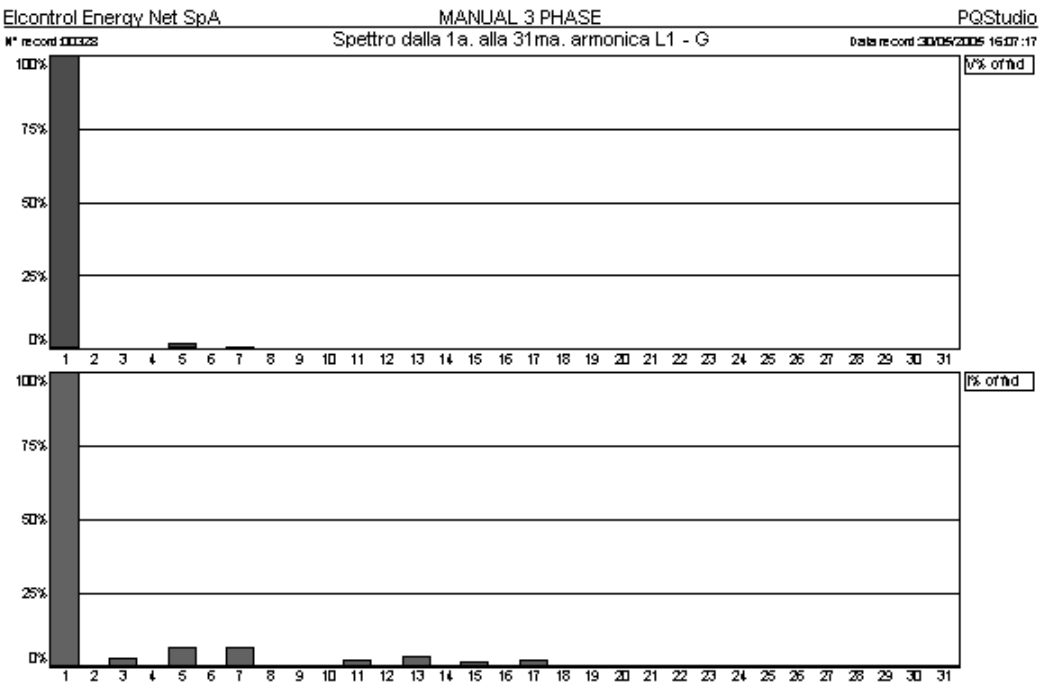
5.3 The harmonic spectrum


Elcontrol Energy Net SpA
MANUAL 3 PHASE
PQStudio
Spettro dalla 1a. alla 31ma. armonica L1 - G
V% of fnd
I% of fnd
100%
75%
50%
25%
0%
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

n.	V	V% of fnd	I	I% of fnd	Cosphi
0	0,00 V		0,00 A		
1	228 V	100 %	36,8 A	100 %	0,994
2	122 mV	0,05 %	0,00 A	0,00 %	
3	55,7 mV	0,02 %	921 mA	2,50 %	0,583
4	95,8 mV	0,04 %	0,00 A	0,00 %	
5	4,12 V	1,80 %	2,43 A	6,60 %	0,737
6	118 mV	0,05 %	0,00 A	0,00 %	
7	974 mV	0,42 %	2,26 A	6,14 %	-0,191
8	41,5 mV	0,01 %	0,00 A	0,00 %	
9	49,4 mV	0,02 %	0,00 A	0,00 %	
10	76,5 mV	0,03 %	0,00 A	0,00 %	
11	877 mV	0,38 %	737 mA	2,00 %	0,397
12	24,6 mV	0,01 %	0,00 A	0,00 %	
13	662 mV	0,29 %	1,22 A	3,31 %	0,128
14	93,4 mV	0,04 %	0,00 A	0,00 %	
15	462 mV	0,20 %	602 mA	1,63 %	-0,160
16	97,7 mV	0,04 %	0,00 A	0,00 %	
17	578 mV	0,25 %	713 mA	1,93 %	-0,099
18	13,6 mV	0,00 %	0,00 A	0,00 %	
19	409 mV	0,17 %	0,00 A	0,00 %	
20	108 mV	0,04 %	0,00 A	0,00 %	
21	145 mV	0,06 %	0,00 A	0,00 %	
22	101 mV	0,04 %	0,00 A	0,00 %	
23	178 mV	0,07 %	0,00 A	0,00 %	
24	112 mV	0,04 %	0,00 A	0,00 %	
25	123 mV	0,05 %	0,00 A	0,00 %	
26	73,0 mV	0,03 %	0,00 A	0,00 %	
27	67,7 mV	0,02 %	0,00 A	0,00 %	
28	38,0 mV	0,01 %	0,00 A	0,00 %	
29	135 mV	0,05 %	0,00 A	0,00 %	
30	156 mV	0,06 %	0,00 A	0,00 %	
31	42,8 mV	0,01 %	0,00 A	0,00 %	

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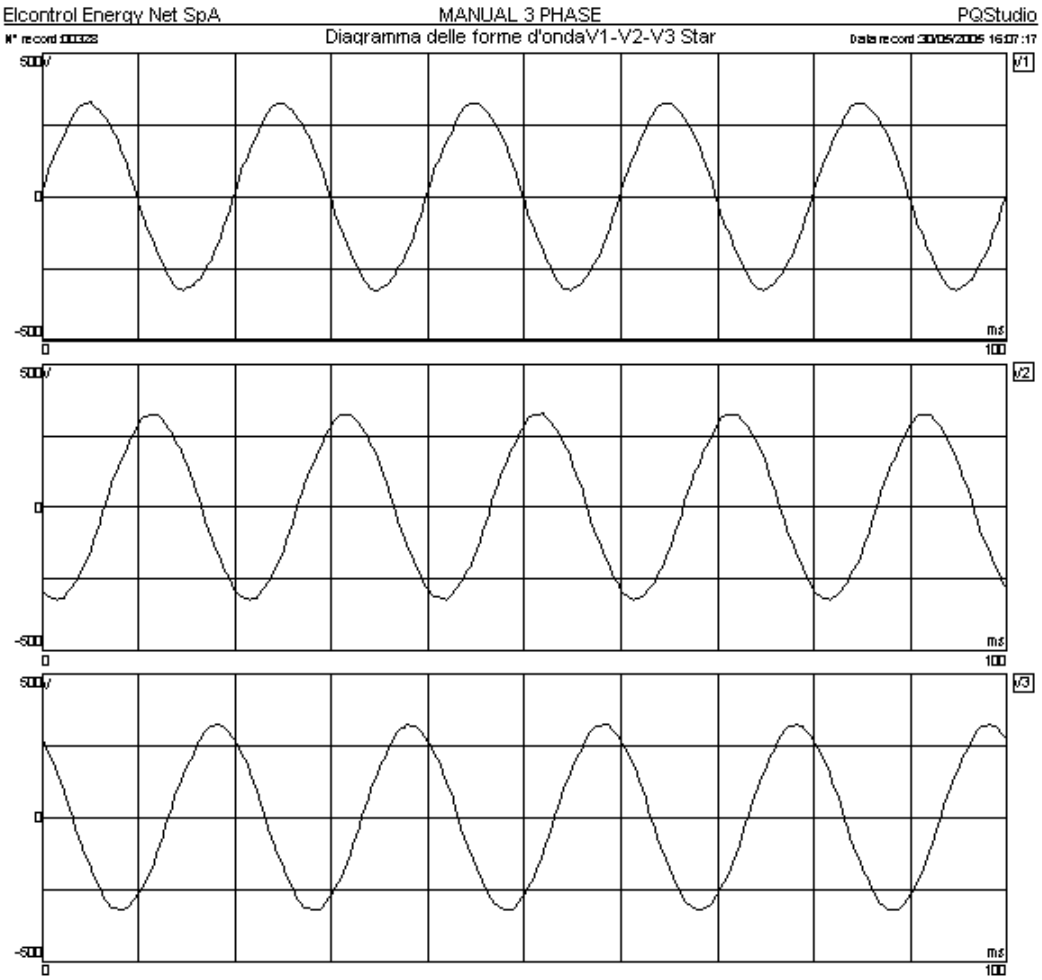
5.4 The voltage and current waveforms



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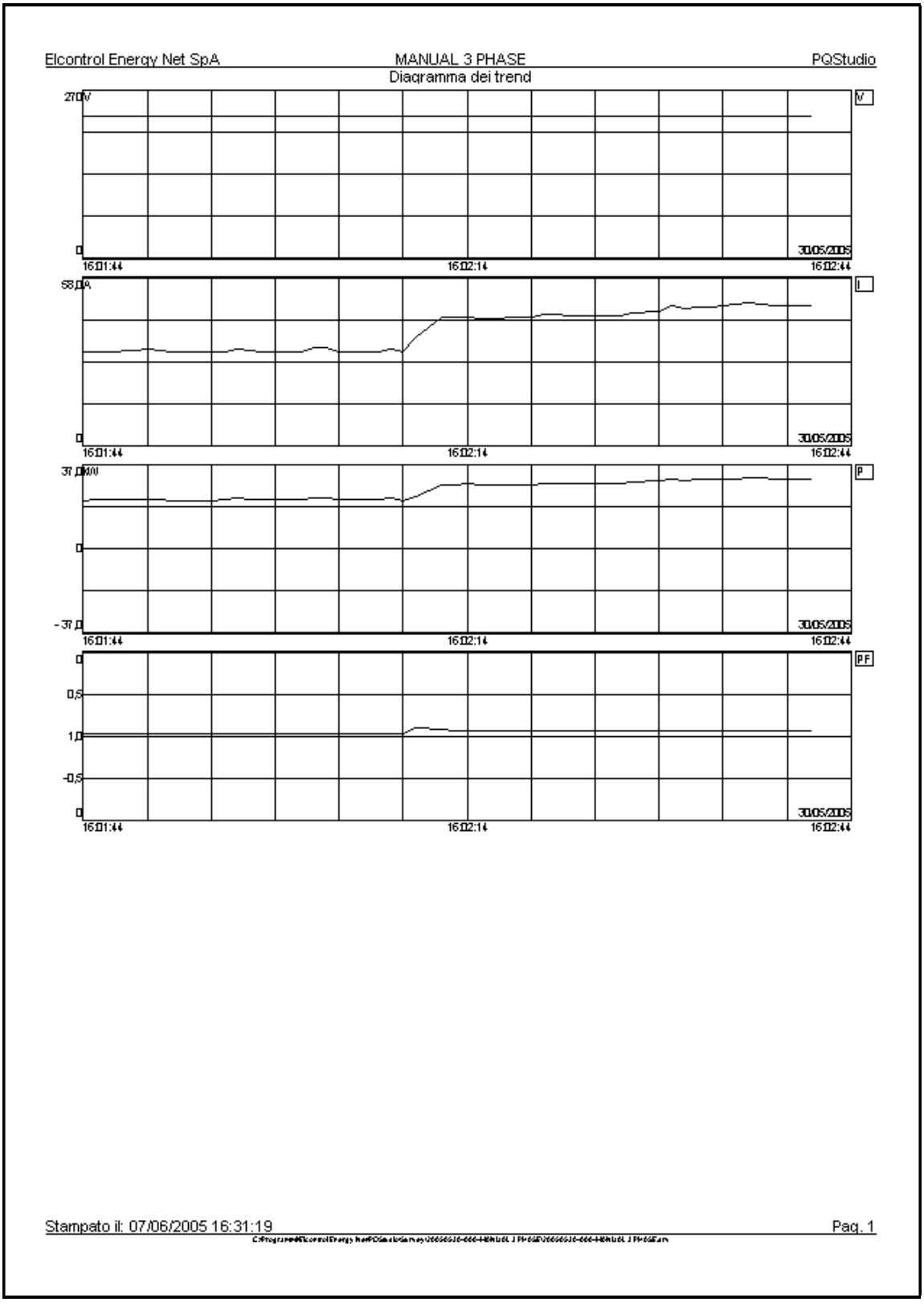
5.5 The time trend of the rms measurements



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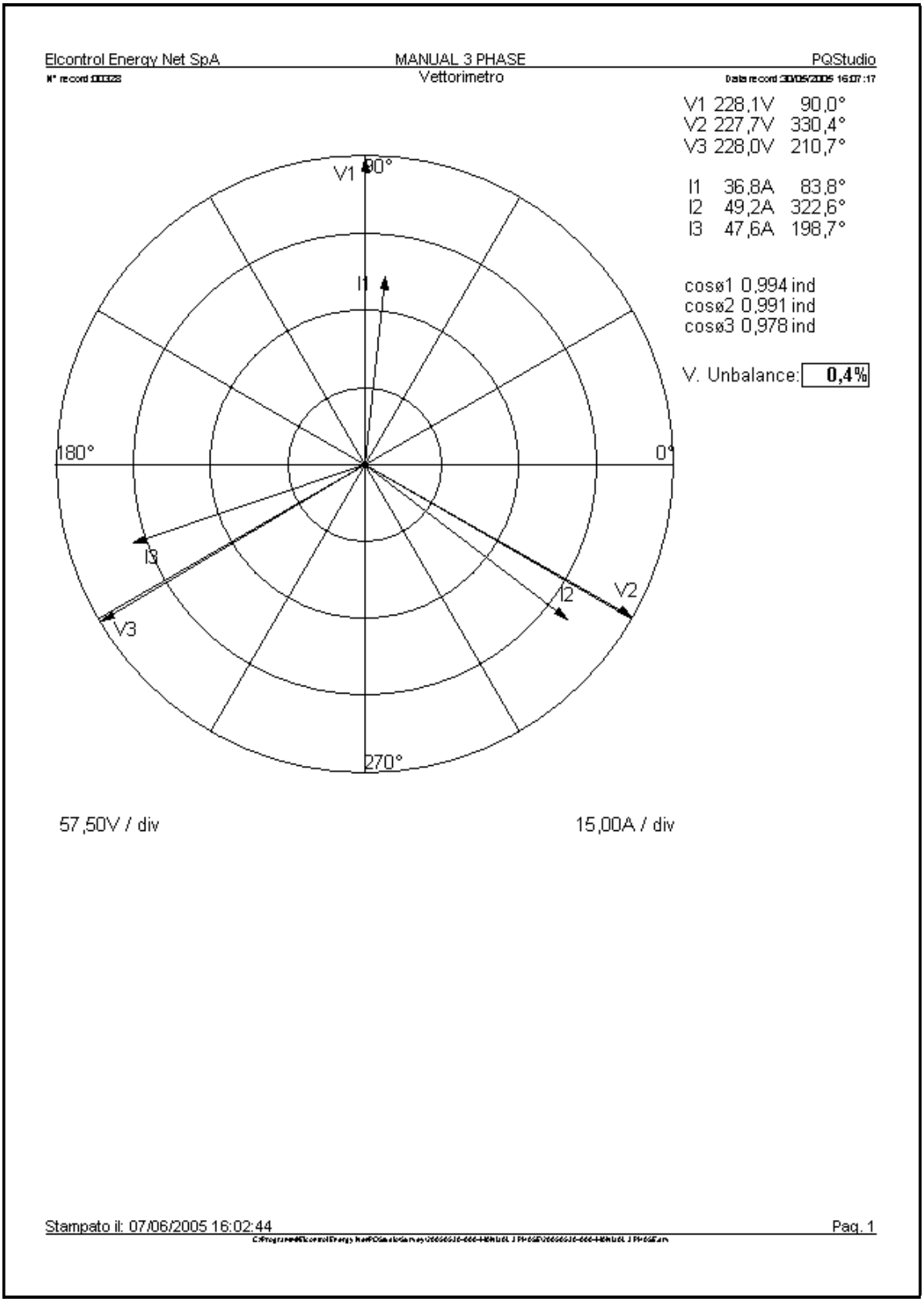
5.6 The vector meter



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5.7 The transients list

Elcontrol Energy Net SpA — TRIGGER — PQStudio

Lista dei transienti

n.	Istante di trigger	Picco V1n	Picco V2n	Picco V3n	Picco I1	Picco I2	Picco I3
1	4/05/2005 18:56:06,417	-457,9 V	-448,8 V	-448,8 V	-77,22 A	-80,78 A	-105,4 A
2	4/05/2005 18:56:17,599	410,5 V	-399,9 V	-399,9 V	-73,54 A	-75,89 A	-262,4 A
3	4/05/2005 18:56:23,672	-398,4 V	-401,4 V	-401,4 V	-72,32 A	-253,3 A	-103,0 A
4	4/05/2005 18:56:28,112	399,2 V	-396,1 V	-396,1 V	-72,32 A	-252,1 A	-99,34 A
5	4/05/2005 18:56:32,551	-399,9 V	393,1 V	393,1 V	-72,32 A	-248,4 A	-99,34 A
6	4/05/2005 18:56:36,611	393,9 V	-384,9 V	-384,9 V	72,32 A	-74,66 A	-98,12 A
7	4/05/2005 18:56:45,432	416,5 V	-402,2 V	-402,2 V	-74,77 A	-75,89 A	101,8 A
8	4/05/2005 18:56:49,081	-537,0 V	478,8 V	478,8 V	-73,54 A	-228,9 A	-95,66 A
9	4/05/2005 18:57:01,612	-426,3 V	-415,7 V	-415,7 V	-74,77 A	-77,11 A	101,8 A
10	4/05/2005 18:57:10,771	388,6 V	-375,1 V	-375,1 V	-71,09 A	-73,44 A	103,0 A
11	4/05/2005 18:57:22,490	426,3 V	-414,9 V	-414,9 V	-75,99 A	-77,11 A	103,0 A
12	4/05/2005 18:58:00,889	422,5 V	-424,7 V	-424,7 V	-74,77 A	-77,11 A	103,0 A
13	4/05/2005 18:58:08,793	-399,9 V	-330,7 V	-330,7 V	-74,77 A	-61,20 A	-96,89 A
14	4/05/2005 18:58:36,512	-360,0 V	-331,5 V	-331,5 V	-74,77 A	-61,20 A	-96,89 A
15	4/05/2005 18:58:57,750	406,7 V	-331,5 V	-331,5 V	-74,77 A	-61,20 A	-96,89 A
16	4/05/2005 18:59:02,220	385,6 V	-332,2 V	-332,2 V	-74,77 A	-62,42 A	-96,89 A
17	4/05/2005 18:59:06,280	-391,6 V	-330,7 V	-330,7 V	-74,77 A	-61,20 A	-96,89 A
18	4/05/2005 18:59:11,369	413,5 V	-332,2 V	-332,2 V	-74,77 A	-62,42 A	96,89 A
19	4/05/2005 18:59:15,939	-389,4 V	-333,0 V	-333,0 V	-74,77 A	-62,42 A	-96,89 A

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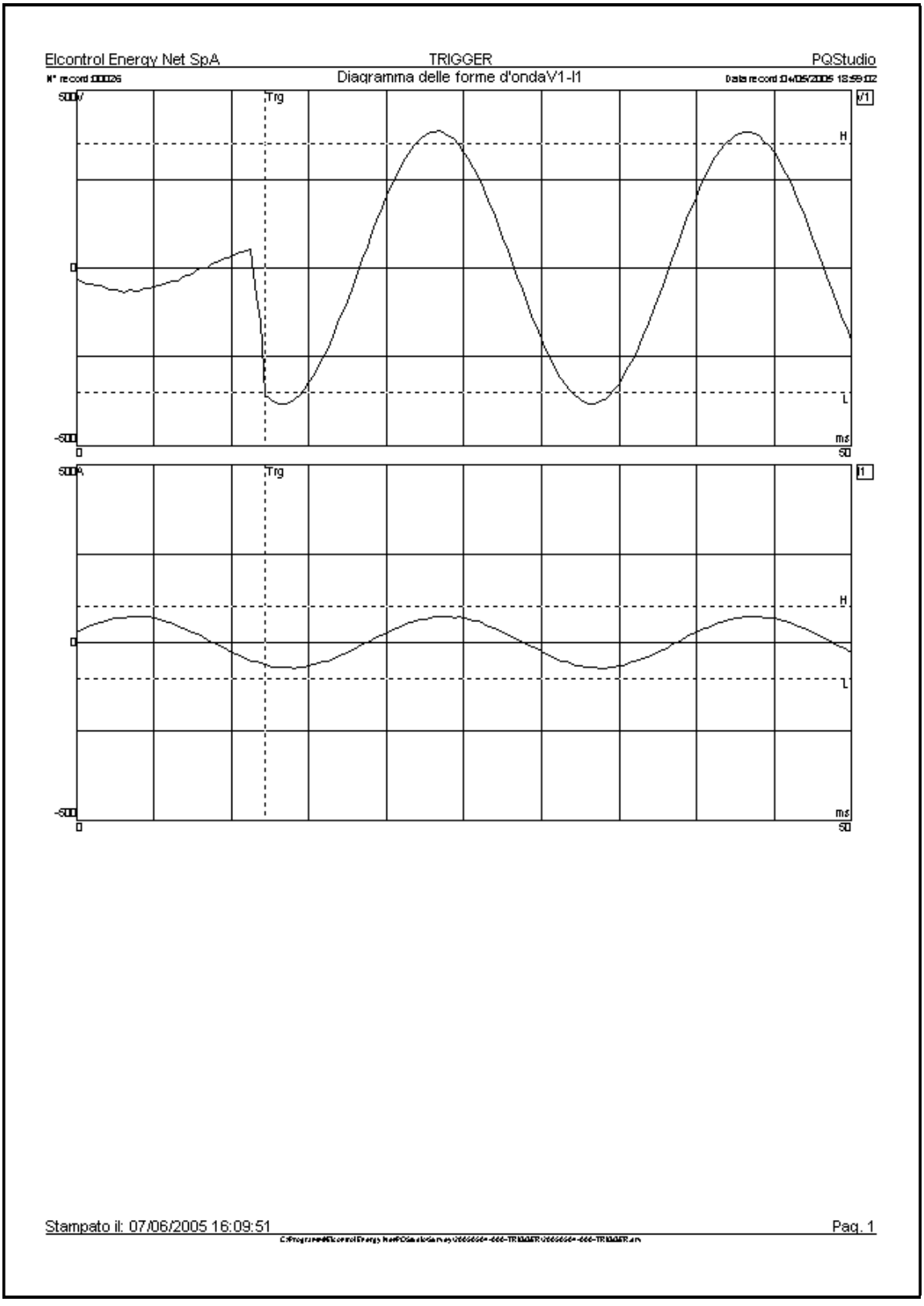
5.8 The voltage and current waveforms (transients)



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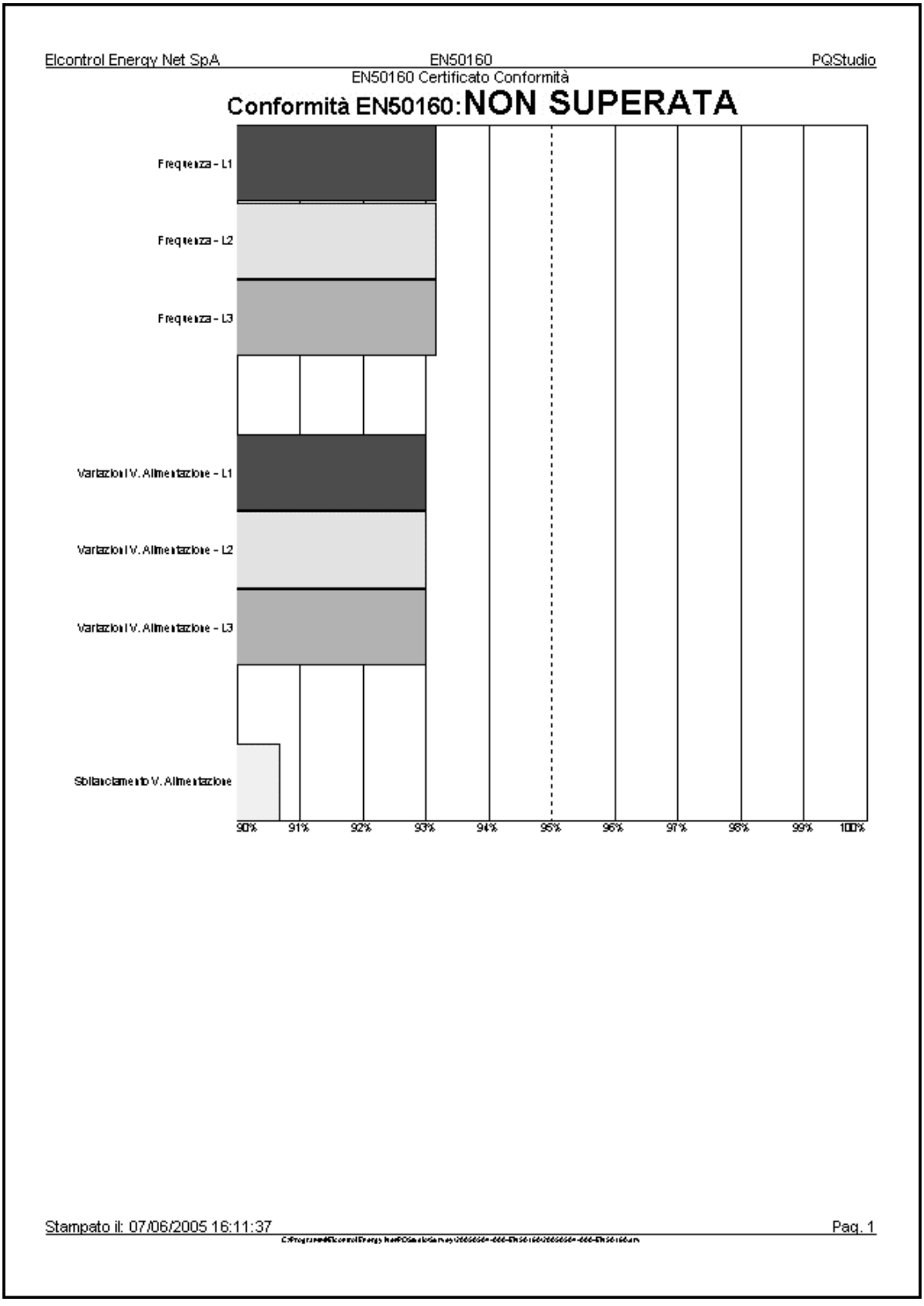
5.9 EN50160 conformity: frequency, changes and voltage unbalance



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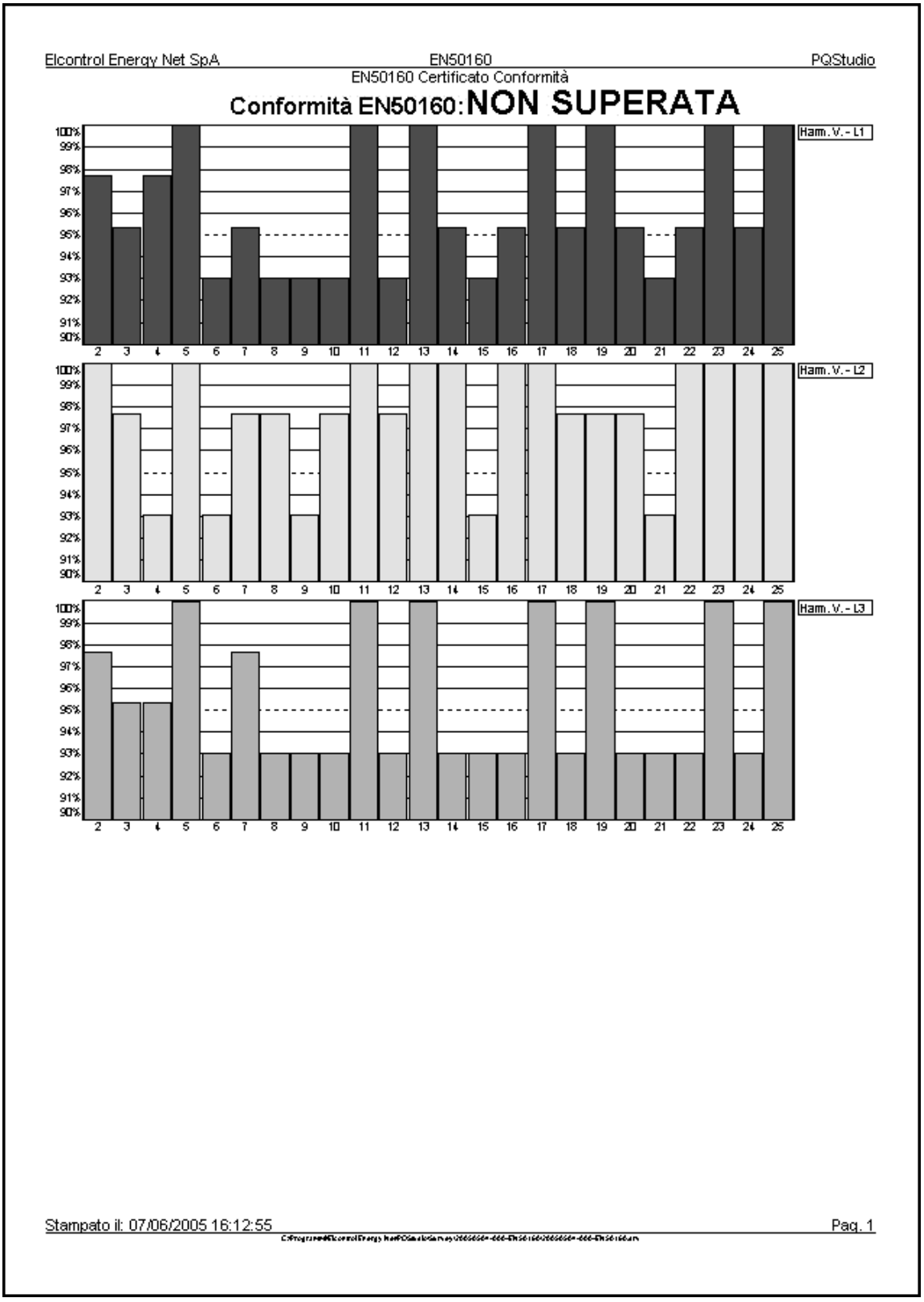
5.10 EN50160 conformity: harmonic voltage



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5.11 List of SAGS events

Elcontrol Energy Net SpA — EN50160 — PQStudio

Sags

n.	Evento	Inizio	Durata	Umax/Ures
1	Interruption	04/05/2005 18:18:01	2,77 s	
2	Dip	04/05/2005 18:18:01	3,42 s	0,00 V
3	Swell	04/05/2005 18:18:03	449 ms	298 V
4	Swell	04/05/2005 18:18:03	37,4 ms	257 V
5	Swell	04/05/2005 18:18:03	12,5 ms	254 V
6	Interruption	04/05/2005 18:18:03	2,00 s	
7	Interruption	04/05/2005 18:18:05	12,5 ms	
8	Interruption	04/05/2005 18:18:05	12,5 ms	
9	Dip	04/05/2005 18:18:03	2,36 s	0,00 V
10	Swell	04/05/2005 18:18:05	462 ms	536 V
11	Interruption	04/05/2005 18:18:05	12,5 ms	
12	Interruption	04/05/2005 18:18:05	1,09 s	
13	Dip	04/05/2005 18:18:05	1,27 s	0,00 V
14	Swell	04/05/2005 18:18:07	962 ms	543 V
15	Interruption	04/05/2005 18:18:08	49,9 ms	
16	Interruption	04/05/2005 18:18:08	1,29 s	
17	Dip	04/05/2005 18:18:08	1,59 s	0,00 V
18	Swell	04/05/2005 18:18:10	837 ms	553 V
19	Interruption	04/05/2005 18:18:10	1,09 s	
20	Dip	04/05/2005 18:18:10	1,29 s	0,00 V
21	Swell	04/05/2005 18:18:11	1,02 s	531 V
22	Interruption	04/05/2005 18:18:13	37,4 ms	
23	Interruption	04/05/2005 18:18:13	1,24 s	
24	Dip	04/05/2005 18:18:13	1,50 s	0,00 V
25	Swell	04/05/2005 18:18:14	2,72 s	557 V
26	Interruption	04/05/2005 18:18:17	74,9 ms	
27	Interruption	04/05/2005 18:18:17	1,74 s	
28	Interruption	04/05/2005 18:18:18	37,4 ms	
29	Dip	04/05/2005 18:18:17	2,12 s	0,00 V
30	Swell	04/05/2005 18:18:18	1,10 s	568 V
31	Interruption	04/05/2005 18:18:26	49,9 ms	
32	Interruption	04/05/2005 18:18:26	1,32 s	
33	Dip	04/05/2005 18:18:26	1,69 s	0,00 V
34	Swell	04/05/2005 18:18:28	2,41 s	564 V
35	Interruption	04/05/2005 18:18:29	49,9 ms	
36	Interruption	04/05/2005 18:18:29	1,60 s	
37	Interruption	04/05/2005 18:18:32	37,4 ms	
38	Dip	04/05/2005 18:18:29	2,01 s	0,00 V
39	Swell	04/05/2005 18:18:32	949 ms	560 V
40	Swell	04/05/2005 18:18:32	25,0 ms	264 V
41	Dip	04/05/2005 18:18:32	12,5 ms	206 V
42	Swell	04/05/2005 18:18:32	12,5 ms	255 V
43	Dip	04/05/2005 18:18:32	37,4 ms	201 V
44	Dip	04/05/2005 18:18:32	37,4 ms	199 V
45	Dip	04/05/2005 18:18:32	37,4 ms	198 V
46	Dip	04/05/2005 18:18:32	25,0 ms	201 V
47	Dip	04/05/2005 18:18:32	25,0 ms	203 V

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5.12 SAGS events table

Elcontrol Energy Net SpA — EN50160 — PQStudio

Tabella Sags

Urms% \ Durata	0.01s < 0.1s	0.1s < 0.5s	0.5s < 1s	1s < 3s	3s < 20s	20s < 60s	1m < 3m
> 200%	0	1	3	4	0	0	0
160% < 200%	0	0	0	0	0	0	0
140% < 160%	0	0	0	0	0	0	0
120% < 140%	0	1	0	0	0	0	0
110% < 120%	4	0	0	0	0	0	0
Unom							
60% < 90%	6	0	0	0	0	0	0
30% < 60%	0	0	0	0	0	0	0
15% < 30%	0	0	0	0	0	0	0
5% < 15%	0	0	0	0	0	0	0

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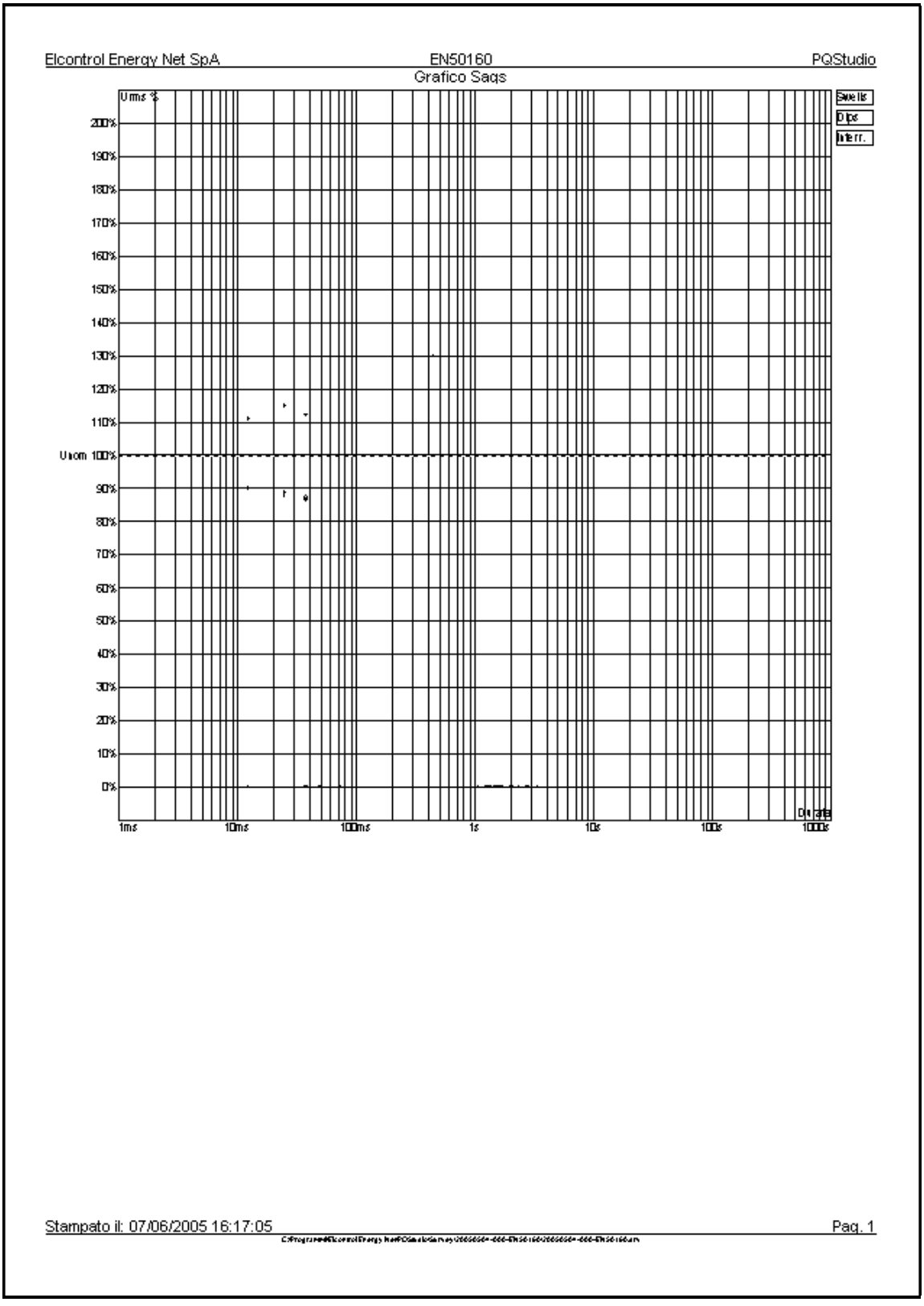
5.13 SAGS array graph



6 System requirements

- PC compatible with 600MHz or higher processor;
- Microsoft Windows 9x, Se, Me, NT 4.0, 2000 or XP;
- 128 MB of RAM memory (512 recommended);
- SVGA with 256 colours 1024x768 or higher resolution;
- 512 MB of free hard disk space, including program installation and the free space necessary for storing a minimum number of measuring campaigns;
- CD/DVD-ROM drive;
- CF reader (external, internal or PCMCIA)
- Pointing system or mouse.

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